



United States
Department of
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Soil
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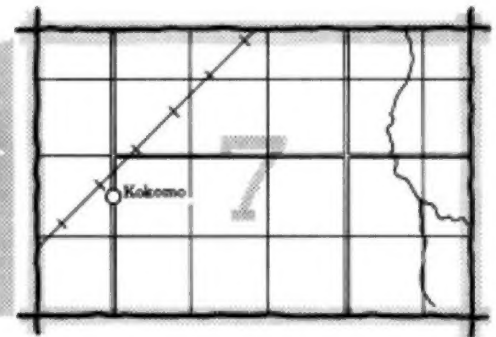
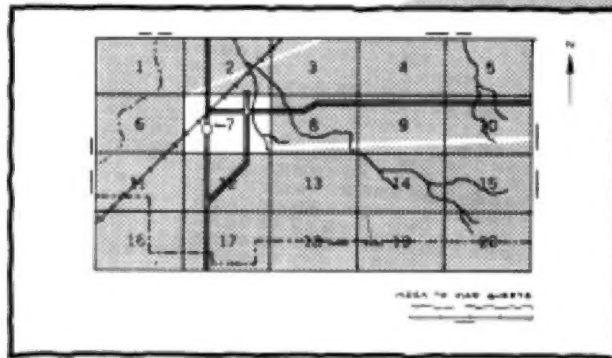
In Cooperation with
United States Department
of Agriculture,
Forest Service, and
Arkansas Agricultural
Experiment Station

Soil Survey of Baxter and Marion Counties Arkansas



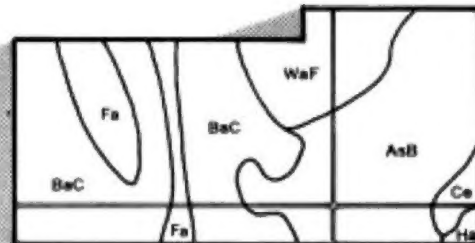
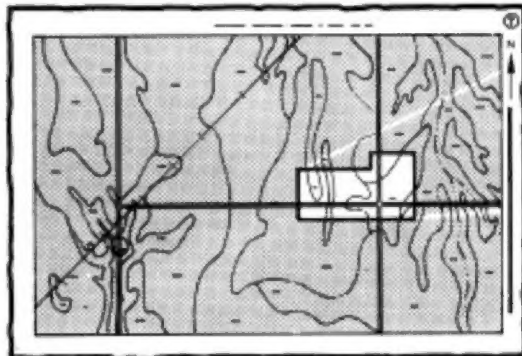
HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets"

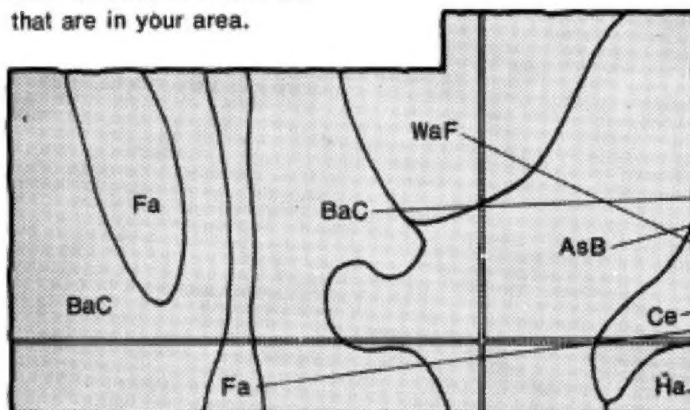


2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



4. List the map unit symbols that are in your area.

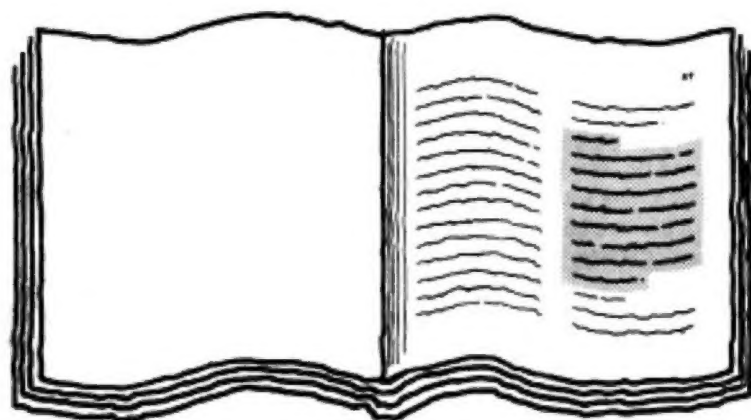


Symbols

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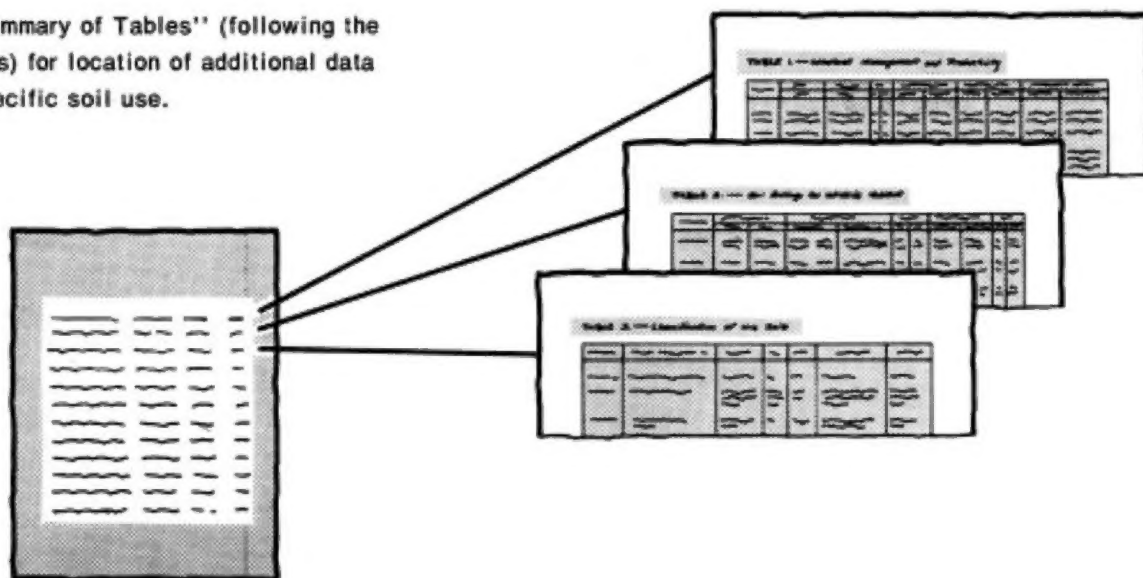
THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



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6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1973-78. Soil names and descriptions were approved in 1978. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1978. This survey was made cooperatively by the Soil Conservation Service, the Forest Service, and the Arkansas Agricultural Experiment Station. It is part of the technical assistance furnished to the Baxter County Conservation District and the Crooked Creek Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Bales of sorghum-sudan hybrid hay. Most farmers use the large round bales to cut down labor costs. The soil is Portia fine sandy loam, 3 to 8 percent slopes.

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foreword

This soil survey contains information that can be used in land-planning programs in Baxter and Marion Counties. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

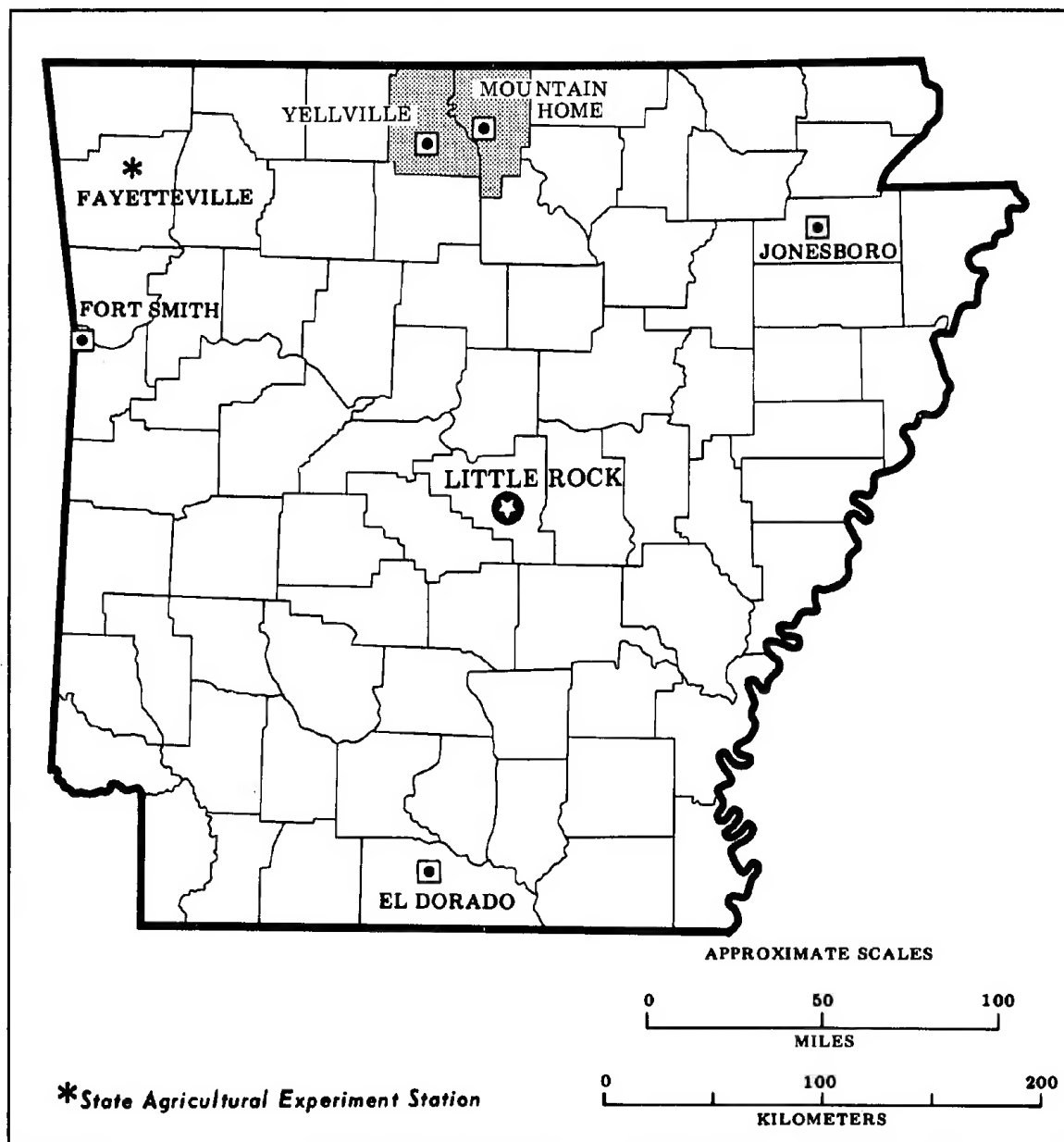
This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.



Maurice J. Spears
State Conservationist
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Location of Baxter and Marion Counties in Arkansas.

soil survey of Baxter and Marion Counties Arkansas

By Larry B. Ward and Richard T. McCright, Soil Conservation Service

United States Department of Agriculture,
Soil Conservation Service and Forest Service,
in cooperation with Arkansas Agricultural Experiment Station

Baxter and Marion Counties are located in north-central Arkansas. The White River forms most of the boundary between the two counties.

Baxter County is irregularly shaped. It is about 36 miles from north to south and 16 miles from east to west. It is bordered on the north by the state of Missouri, on the west by Marion County, on the south by Stone County, and on the east by Fulton and Izard Counties.

The total area of the county is about 369,920 acres or about 578 square miles. The total land area is about 343,744 acres and includes 2,820 acres of water in bodies of less than 40 acres and in streams less than one-eighth of a mile wide. In 1970 the population was 15,319. Mountain Home is the county seat and the main trade center. There are six smaller incorporated cities in the county.

Marion County is rectangular in shape and is about 30 miles from north to south and 21 miles from east to west. It is bordered on the north by the state of Missouri, on the west by Boone County, on the south by Searcy County, and on the east by Baxter County. The total area of the county is about 407,680 acres or about 637 square miles. The total land area is about 373,632 acres and includes 3,460 acres of water in bodies of less than 40 acres and in streams less than one-eighth of a mile wide. In 1970 the population was 7,000. Yellville is the county seat and the main trade center. There are four smaller incorporated cities in the county.

The economy of the two counties is based on livestock and poultry production, tourism, retirement income, small industry, and business.

general nature of the survey area

Farming, physiography, and drainage are discussed in this section.

farming

The first settlers in Baxter and Marion Counties were mostly subsistence farmers. They cleared and farmed small scattered areas on flood plains and on gently sloping uplands where the soil was deep and contained less gravel or stones. The settlers built roads and developed markets. They cleared more areas on the uplands for cotton, corn, and small grains, and they raised livestock for cash sale. They also cut and sold the virgin hardwood timber. This trend continued until about 1930. From 1930 through the 1950's numerous farms were abandoned, and many farms went from cultivated crops to pasture or meadow. At present, very little land in Baxter and Marion Counties is cultivated. Nearly all of the cleared land is used for pasture and forage crops.

According to the 1974 Census of Agriculture, farms in Baxter and Marion Counties are decreasing in number and size. About 25 percent of Baxter County and 36 percent of Marion County is farmland. The remainder of the land is taken up by cities, towns, reservoirs, rural subdivisions, federally owned land, and transportation and utility facilities.

In Baxter County in 1969, there were 459 farms, the average farm was 225 acres, and 103,441 acres, or 30.1 percent of the county, was in farms. In 1974, however, there were 411 farms, the average farm was 213 acres, and 87,371 acres, or 25.4 percent of the county, was in farms.

In Marion County in 1969, there were 554 farms, the average farm was 274 acres, and 151,853 acres, or 40.6 percent of the county, was in farms. In 1974, however, there were 497 farms, the average farm was 267 acres, and 132,756 acres, or 35.5 percent of the county, was in farms.

Most farm income is from livestock, mainly beef cattle. The cattle industry consists of mainly cow-calf operations (fig. 1). Table 1 shows the livestock and poultry sold in selected years for Baxter County and Marion County. Most calves are sold as weaners or as stockers the following year. Most cattle produced in the two-county area are sold to the midwestern feedlots. They are raised in pastures on both cool and warm season grasses and given mineral and protein supplements. Generally, they are fed grain feeds and hay in winter months only. The production of pigs and hogs has fluctuated considerably, primarily because of market prices. There has been a substantial increase in the production of turkeys and broilers in recent years, a trend that is likely to continue.

The sale of forest products is increasing in the two counties, even though the woodland is mostly on steep, stony, or shallow soils, which are poor sites for commercial timber production. Most privately owned woodland is low grade hardwoods on uplands or mixed stands of oak and shortleaf pine. Most of southern Baxter County is the Ozark National Forest. This area is being managed for production of oak and pine timber. Most of the hardwood timber is sold locally and sawed into railroad ties, hardwood flooring, or handle, pallet, and furniture stock. Mill scraps are used to make charcoal. A large amount of pine timber is treated with preservatives and sold for post and wood fencing. A small amount is sawed into lumber at local mills. Some pine is sold locally as pulpwood, which is then shipped to papermills in southern Arkansas. The shallow soils in northern Baxter and Marion Counties produce cedar trees, which are used for posts, lumber, furniture, and novelties.

The major crops in the two-county area are improved pasture and forage crops. Table 2 shows acreage of



Figure 1.—The major farm enterprise in the survey area is cow-calf operations. The soil is *Captina silt loam*, 1 to 3 percent slopes.

principal crops in Baxter and Marion Counties in selected years. The production of silage, corn, and other grain crops fluctuates depending on the number of livestock.

Of the resident farm owners in the two-county area, more than half have off-the-farm jobs or are retired. Many retirees have moved into the area and have bought small acreages to farm.

physiography and drainage

Baxter and Marion Counties are within two physiographic areas of the Ozark Highland. The Salem Plateau is exposed across northern and eastern Marion County and across northern and central Baxter County. The Springfield Plateau is exposed in parts of west central and across most of southern Marion County and most of southern Baxter County. In addition, a small outlier of the Boston Mountains rises above the Springfield Plateau in extreme southwestern Baxter County.

The Salem Plateau is characterized by gently sloping to rolling uplands, and steep, stony side slopes with outcrops of dolomite. The elevation ranges from about 700 to 1,000 feet above sea level. There are a few broad areas on uplands that have a gradient of 1 to 8 percent. Arkana, Doniphan, Gassville, and Moko soils are the major soils on this plateau surface.

The Springfield Plateau is adjacent to and higher in elevation than the Salem Plateau. This plateau has been strongly dissected by streams. It is characterized by steep, V-shaped valleys separated by gently sloping to moderately sloping, long, narrow, winding ridges. The side slopes have a gradient of 12 to 50 percent. The elevation atop the ridges ranges from about 1,000 to 1,200 feet above sea level. There are a few broad areas on uplands where the gradient is 1 to 8 percent. Clarksville, Nixa, and Noark soils are the major soils on the Springfield Plateau.

Stream valleys are entrenched and are commonly less than one-fourth mile wide. Most flood plains are 100 to 1,000 feet wide. Healing, Razort, Wideman, and Britwater soils formed in these areas.

The White, Norfolk, and Buffalo Rivers and Crooked Creek flow through the two counties, and there are several smaller intermittent and perennial streams. The natural drainage system consists of many streams in a dendritic pattern in the upper reaches of several watersheds. Springs are common in some areas and contribute substantially to summer and fall streamflow of some streams.

The northern part of Marion County is drained by Bull Shoals Reservoir, which was built on the White River in 1951. Bull Shoals Reservoir has a surface area of about 34,000 acres. In addition to water storage, the reservoir is used for water recreation. The major streams draining northward into Bull Shoals Reservoir are Sugarloaf, Music, and Moccasin Creeks. The central part of Marion County is drained by Crooked Creek, which flows

eastward and empties into the White River about 8 miles below Bull Shoals Reservoir. The southern part of Marion County is drained by the Buffalo River, which flows in a meandering pattern across the southeast corner of the county. The Buffalo River flows in a general northeasterly direction and empties into the White River about 18 miles below Bull Shoals Reservoir. The major streams that drain into the Buffalo River are Tomahawk, Water, Panther, Rush, Clabber, Blue John, and Cedar Creeks.

The northwestern part of Baxter County is drained by Bull Shoals Reservoir, which covers a little over a thousand acres in Baxter County. The central portion of the county is drained by the White River, which flows in a southerly direction along the western border of the county for about 18 miles, then turns abruptly eastward, bisecting the county. Some of the major streams which drain into the White River are Bruce, Hightower, Lithis, Jenkins, and Big Creeks. The east side of Baxter County is drained by Norfolk Reservoir and the Norfolk River. Norfolk Reservoir has a surface area of approximately 26,000 acres in Baxter County. This major multipurpose reservoir is important for water related recreation. The southwest part of the county is drained by numerous small streams that eventually flow into the Buffalo River. The southeast corner is drained by several small streams that flow into Sylamore Creek and eventually into the White River further south.

Domestic water supplies come from drilled or dug wells, springs, or large reservoirs in Baxter and Marion Counties. All incorporated towns in both counties have public water systems. There are also several water improvement districts which supply rural residents with water. Livestock water comes mainly from farm ponds, creeks, and branches.

climate

Prepared by the National Climatic Center, Asheville, North Carolina.

The Marion and Baxter County area is hot in summer, especially at low elevations, and moderately cool in winter, especially on mountains and high hills. Rainfall is fairly heavy and well distributed throughout the year. Snow falls nearly every winter, but snow cover lasts but a few days.

Table 3 gives data on temperature and precipitation for the survey area as recorded at Mountain Home, Arkansas in the period 1953 to 1977. Table 4 shows probable dates of the first freeze in fall and the last freeze in spring. Table 5 provides data on length of the growing season.

In winter the average temperature is 37 degrees F, and the average daily minimum temperature is 25 degrees. The lowest temperature on record, which occurred at Mountain Home on January 24, 1963, is -5 degrees. In summer the average temperature is 77 degrees, and the average daily maximum temperature is

89 degrees. The highest recorded temperature, which occurred at Mountain Home on July 15, 1954, is 113 degrees.

Growing degree days are shown in table 3. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 43 inches. Of this, 24 inches, or 55 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 19 inches. The heaviest 1-day rainfall during the period of record was 5.42 inches at Mountain Home on November 25, 1973. Thunderstorms occur on about 60 days each year, and most occur in summer.

Average seasonal snowfall is 9 inches. The greatest snow depth at any one time during the period of record was 17 inches. On an average of 4 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 12 miles per hour, in spring.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of

drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil maps at the back of this publication show broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil maps is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil maps can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The soils in the survey area vary widely in their potential for major land uses.

Each map unit is rated for *cultivated crops, pasture crops, woodland*, and *urban uses*. Cultivated crops are those grown extensively in the survey area. Pasture crops are those grown for livestock forage production. Woodland refers to areas of native or introduced trees. Urban uses include residential, commercial, and industrial developments.

soil descriptions—Baxter County

areas dominated by deep, moderately deep, and shallow, nearly level to steep soils; on ridgetops, side slopes, and broad uplands

The soils in these areas make up about 67 percent of Baxter County. They are in the central, west central, and northern parts of the county. The soils are loamy and are cherty, very cherty, or stony. They formed in material that weathered from level-bedded dolomite on the Salem Plateau.

1. Arkana-Moko

Moderately deep and shallow, gently sloping to steep, well drained, cherty and stony soils that formed in residuum of dolomite and limestone

These soils are scattered throughout the part of Baxter County north of the White River. They are on side slopes and ridgetops of the Salem Plateau.

This map unit makes up about 31 percent of the county. Arkana soils make up about 38 percent of the unit, Moko soils make up 30 percent, and soils of minor extent make up 32 percent.

Arkana and Moko soils are generally intermingled on the same landscape. Both soils are well drained. Arkana soils are moderately deep, and Moko soils are shallow. Arkana soils have a surface layer of very dark grayish brown very cherty silt loam. The subsoil is yellowish red very cherty silty clay, yellowish red cherty clay, and dark yellowish brown clay. The underlying material is hard dolomite bedrock. Moko soils consist of very dark brown and very dark grayish brown very stony silt loam about 12 inches thick overlying hard dolomite bedrock.

The minor soils in this map unit are Gassville and Doniphan soils on a landscape similar to that of Arkana and Moko soils. These soils are intermingled with areas of rock outcrop. Razort and Elsay soils along drainageways also are minor soils.

The soils in this unit are used mainly as woodland. The trees are eastern redcedar and low grade hardwoods. In some gently sloping areas that have been cleared, the soils are used for pasture. Originally, these soils, in most areas, were in open stands of hardwoods and redcedar. Prairie plants grew in the openings.

Arkana and Moko soils are not suited to cultivated crops. The depth to bedrock, stones on the surface, the hazard of erosion, and slope are the main limitations to use of the soils for farming and for most other uses. Arkana soils are poorly suited to pasture and woodland use. Moko soils are not suited to improved pasture, and they are poorly suited to woodland use. Arkana and Moko soils are poorly suited to most urban uses because of the slope, a high shrink-swell potential, and depth to bedrock. Low soil strength is a limitation for local roads and streets. The limitations are difficult and in most places impractical to overcome.

2. Captina-Tonti-Nixa

Deep, nearly level to moderately sloping, moderately well drained, loamy and cherty soils that formed in residuum of cherty dolomite

These soils are mostly in the central part of Baxter County, around Mountain Home, Midway, and Gassville. These areas are on broad upland flats on the Salem Plateau.

This map unit makes up about 2 percent of the county. Captina soils make up about 40 percent of the unit, Tonti

soils make up 28 percent, Nixa soils make up 24 percent, and soils of minor extent make up the rest.

Captina soils are nearly level to gently sloping. They have a surface layer of dark brown silt loam. The subsoil in the upper part is yellowish brown and strong brown silt loam and silty clay loam. The middle part is a compact and brittle fragipan of mottled, strong brown, light gray, yellowish red and yellowish brown cherty and very cherty silty clay loam. The lower part is red cherty clay.

Tonti soils are cherty. They are gently sloping. They have a surface layer of brown cherty silt loam. The subsoil in the upper part is strong brown cherty silt loam. The middle part is a compact and brittle fragipan of strong brown, mottled cherty silt loam. The lower part is red clay.

Nixa soils are very cherty. They are gently sloping to moderately sloping. The surface layer is very dark grayish brown very cherty silt loam. The subsoil in the upper part is light yellowish brown very cherty silt loam. The middle part is a compact and brittle fragipan of yellowish brown, mottled very cherty silt loam. The lower part is mottled yellowish red, strong brown, and light brownish gray very cherty silty clay loam.

The minor soils in this map unit are the very cherty Doniphan and cherty Ventris soils on a landscape similar to that of Captina, Tonti, and Nixa soils.

The soils in this unit are mainly used for pasture and hay. Originally, these soils, in most areas, were in scattered hardwoods with an understory of tall grasses.

Captina and Tonti soils are well suited to moderately suited to cultivated crops and Nixa soils are poorly suited. Slope, slow permeability, erosion hazard, and cherty surface layer are moderate limitations to use of these soils for farming. Captina and Tonti soils are well suited to pasture and Nixa soils are moderately suited. These soils are moderately suited to woodland use. These soils are well suited to moderately suited to most urban uses. Slope, low strength, and wetness are limitations that can usually be overcome on these soils. Low strength is a limitation only for local roads and streets. Most areas have slow permeability, which is a limitation that is generally difficult to overcome.

3. Doniphan-Gassville

Deep and moderately deep, moderately sloping to steep, well drained, very cherty soils that formed in residuum of cherty dolomite

These soils are scattered throughout the central and northern parts of Baxter County. These areas are on uplands of the Salem Plateau.

This unit makes up about 22 percent of the county. Doniphan soils make up about 60 percent of the unit, Gassville soils make up 28 percent, and soils of minor extent make up the rest.

Doniphan soils are deep and well drained. They are on moderately sloping uplands. They have a surface layer of

dark brown very cherty silt loam. The subsoil is strong brown very cherty silt loam, yellowish red, mottled cherty silty clay, and dark red and mottled dark red, strong brown, and light gray clay.

Gassville soils are moderately deep and well drained. They are on steep side slopes. They have a surface layer of dark brown very cherty silt loam. The subsoil is strong brown very cherty silt loam, yellowish red cherty clay, and mottled, red and yellowish brown clay. Below the subsoil there is highly fractured, rippable siltstone over hard, level-bedded dolomite bedrock.

The minor soils in this map unit are the very cherty Nixa soils on a landscape similar to that of Doniphan soils and the very cherty Arkana and stony Moko soils on a landscape similar to that of Gassville soils. Razort and Elsayh soils along drainageways are also minor soils.

The soils in this map unit are used mainly as woodland or pasture (fig. 2). Doniphan soils in most of the less sloping areas are cleared and in pasture. The steep Gassville soils are primarily in low grade upland hardwoods. Originally, these soils, in most areas, were in mixed upland hardwoods.

Doniphan soils are generally not suited to cultivated crops and are moderately suited to pasture. The steep Gassville soils are not suited to cultivated crops and poorly suited to improved pasture. Slope, erosion hazard, and surface chert are the main limitations to use of these soils for farming and most other uses. These soils are moderately suited to woodland use. Doniphan soils are poorly suited to most urban uses because of slope and moderate permeability. Low strength is a limitation for local roads and streets. These limitations are often difficult to overcome on these soils. Gassville soils are poorly suited to most urban use because of slope, depth to bedrock, and slow permeability. Low strength is a limitation for local roads and streets. These limitations are difficult and generally impractical to overcome on these soils.

4. Doniphan-Nixa

Deep, gently sloping to moderately sloping, well drained and moderately well drained, very cherty soils that formed in residuum of cherty dolomite

These soils are primarily in the central and west central part of Baxter County. These soils are on ridgetops and undulating to rolling uplands on the Salem Plateau.

This map unit makes up about 10 percent of the county. Doniphan soils make up 52 percent of the unit, Nixa soils make up 40 percent, and soils of minor extent make up the rest.

Doniphan soils are well drained. They are on uplands. They have a surface layer of dark brown very cherty silt loam. The subsoil is strong brown very cherty silt loam,



Figure 2.—Typical landscape in an area of Doniphan-Gassville soils. The moderately sloping Doniphan soils have been cleared and seeded to tall fescue. The steep Gassville soils remain in mixed hardwoods.

yellowish red mottled cherty silty clay, and dark red and mottled dark red, strong brown, and light gray clay.

Nixa soils are moderately well drained. They are on ridges and uplands. They have a surface layer of very dark grayish brown very cherty silt loam. The subsoil in the upper part is light yellowish brown very cherty silt loam. The middle part is a compact and brittle fragipan of yellowish brown, mottled very cherty silt loam. The lower part is mottled, yellowish red, strong brown, and light brownish gray very cherty silt loam.

The minor soils in this unit are Captina and Tonti soils on a landscape similar to that of Doniphan and Nixa soils and Gassville soils on steeper side slopes.

The soils in this map unit are used mainly for pasture. Originally, the soils in most areas were in open stands of mixed upland hardwoods.

Doniphan and Nixa soils are moderately suited to not suited to cultivated crops, depending on slope. Slope, erosion hazard, high chert content, and slow permeability are the main limitations of these soils for farming and most other uses. They are moderately suited to pasture and to woodland use. These soils are moderately to poorly suited to most urban uses because of slope and moderate permeability. Low strength is a limitation for local roads and streets. These limitations can generally be overcome. Some areas have slow permeability, which is generally difficult to overcome.

5. Doniphan-Ventris

Deep and moderately deep, gently sloping, well drained and moderately well drained, very cherty and cherty soils that formed in residuum of cherty dolomite

These soils are mainly in the central part of Baxter County around the city of Mountain Home. They are on broad uplands of the Salem Plateau.

This map unit makes up about 2 percent of the county. Doniphan soils make up about 45 percent of this unit, Ventris soils make up about 45 percent, and soils of minor extent make up the rest.

Doniphan soils are deep and well drained. They have a surface layer of dark brown very cherty silt loam. The subsoil is strong brown very cherty silt loam, yellowish red mottled cherty silty clay, and dark red and mottled, dark red, strong brown, and light gray clay.

Ventris soils are moderately well drained and moderately deep. They have a surface layer of very dark grayish brown cherty silt loam. The subsoil is yellowish brown clay. Below the subsoil there is hard, level-bedded dolomite bedrock.

The minor soils in this map unit are Arkana, Moko, and Captina soils on a landscape similar to that of Doniphan and Ventris soils.

The soils in this map unit are used mainly for pasture and hay, but small areas are in low grade upland hardwoods. Originally, these soils, in most areas, were in mixed upland hardwoods. Surface chert, slope, and an erosion hazard are the main limitations to use of these soils for farming.

Doniphan soils are moderately suited to cultivated crops and pasture. Ventris soils are poorly suited to cultivated crops and pasture. Doniphan soils are moderately suited and Ventris soils are poorly suited to woodland use. Doniphan soils are moderately suited to most urban uses because of slope and moderate permeability. Low strength is a limitation for local roads and streets. These limitations can usually be overcome on the soils. Ventris soils are poorly suited to residential and community development uses because of very slow permeability and depth to bedrock. Low strength is a limitation for local roads and streets. These limitations are difficult and generally impractical to overcome.

areas dominated by deep, level to gently sloping soils; on flood plains and stream terraces

The soils in these areas make up about 3 percent of Baxter County. They are along the White River, Norfolk River, Bennetts River, Bennetts Bayou, and smaller streams throughout the county. They are loamy soils that formed in alluvial sediment.

6. Healing-Razort-Britwater

Deep, level to gently sloping, well drained, loamy soils that formed in alluvium

These soils are on flood plains and terraces along the White River, Norfolk River, Bennetts River, Bennetts Bayou, and smaller streams.

This map unit makes up about 3 percent of the county. Healing soils make up about 30 percent of the map unit, Razort soils make up 27 percent, Britwater soils make up 26 percent, and soils of minor extent make up the rest.

Healing soils are on flood plains of the White River and Norfolk River. These soils are protected from a flood hazard by flood retarding structures upstream. They have a surface layer of dark brown silt loam. The subsoil is brown silt loam, reddish brown silt loam, and brown silt loam.

Razort soils are on flood plains. They are frequently flooded. They have a surface layer of dark brown silt loam. The subsoil is dark brown loam, dark yellowish brown gravelly loam, and dark brown silty clay loam. Below the subsoil there is brown very gravelly loamy sand.

Britwater soils are well drained. They are on terraces. They have a surface layer of dark yellowish brown silt loam or gravelly silt loam. The subsoil is dark brown silt loam or gravelly silt loam, yellowish red silty clay loam or gravelly silty clay loam, red gravelly silty clay loam, gravelly clay loam, and very gravelly silty clay.

The minor soils in this map unit are very cherty Elsay soils. Gravel bars and areas of sandy and gravelly overwash are included.

The soils in this map unit are used mainly for pasture and hay, but for 60 to 90 years much of the acreage was cultivated. Originally, these soils, in most areas, were in a dense stand of mixed hardwoods.

Healing soils are well suited to cultivated crops and pasture. Razort soils are poorly suited to cultivated crops because of a severe flood hazard. They are well suited to pasture. Britwater soils are well suited to moderately suited to cultivated crops, depending on slope. They are well suited to pasture. Healing and Razort soils are well suited and Britwater soils are moderately suited to woodland use. Healing soils are well suited to most urban uses. Low strength is a severe limitation for local roads and streets, and moderate permeability is a moderate limitation for other urban uses. Razort soils are poorly suited to most urban uses because of a severe flood hazard. Flood control measures are usually needed to overcome this limitation. Britwater soils are well suited to moderately suited to most urban uses because of slope and moderate permeability. Low strength is a limitation for local roads and streets.

areas dominated by deep and shallow, gently sloping to steep soils; on broad upland areas, side slopes, and foot slopes

The soils make up about 20 percent of Baxter County. They are in the southern part of the county. The soils are loamy and stony. They formed in material that weathered from sandstone or interbedded sandstone

and limestone on the Salem Plateau and at lower elevations of the Springfield Plateau.

7. Brockwell-Portia

Deep, gently sloping to moderately steep, well drained, loamy soils that formed in residuum of sandstone and interbedded sandstone and limestone

These soils are mostly in the southern part of Baxter County. They are on broad upland areas, side slopes, and foot slopes.

This map unit makes up about 7 percent of the county. Brockwell soils make up about 55 percent of this unit, Portia soils make up 36 percent, and soils of minor extent make up the rest.

Brockwell soils are well drained. They are on gently sloping to moderately steep uplands. They have a surface layer of dark grayish brown sandy loam or gravelly sandy loam. The subsoil is strong brown sandy loam or gravelly sandy loam, strong brown and pale brown fine sandy loam or gravelly fine sandy loam, and mottled, strong brown, pale brown, and red sandy clay loam or gravelly sandy clay loam.

Portia soils are well drained. They are on gently sloping to moderately sloping uplands and foot slopes. They have a surface layer of brown fine sandy loam. The subsoil is dark brown sandy loam, reddish brown sandy clay loam, and red sandy clay loam.

The minor soils in this map unit are the stony Estate and Doniphan soils on a landscape similar to that of Brockwell and Portia soils. Areas of sandstone outcrops and small areas of Wideman and Razort soils along drainageways are also included.

The soils in this map unit are used mainly for pasture or woodland. Originally, these soils, in most areas, were in mixed upland hardwoods and pines.

Brockwell and Portia soils are moderately suited to poorly suited to cultivated crops, depending on slope. Slope and an erosion hazard are the main limitations of these soils for farming and most other uses. They are well suited to improved pasture and moderately suited to woodland use. These soils are well suited to moderately suited to most urban uses because of slope and moderate permeability. Low strength is a limitation for local roads and streets.

8. Estate-Portia-Moko

Deep and shallow, gently sloping to steep, well drained, stony and loamy soils that formed in residuum and colluvium of interbedded sandstone and limestone

These soils are mainly in the southern part of Baxter County. They are on gently sloping to rolling uplands on the Salem Plateau and on gently sloping to moderately sloping foot slopes and steep side slopes at lower elevations on the Springfield Plateau.

This map unit makes up about 13 percent of the county. Estate soils make up about 26 percent of this

unit, Portia soils make up about 20 percent, Moko soils make up 16 percent, and soils of minor extent make up the rest.

Estate soils are on steep side slopes at higher elevations. They have a surface layer of dark grayish brown stony sandy loam. The subsoil is yellowish red sandy loam, yellowish red clay loam, and red clay.

Portia soils are on foot slopes. They have a surface layer of brown fine sandy loam. The subsoil is dark brown sandy loam and reddish brown and red sandy clay loam.

Moko soils are on side slopes. They consist of very dark brown and very dark grayish brown stony silt loam about 12 inches thick overlying hard limestone bedrock.

The minor soils in this map unit are very cherty Clarksville and Noark soils on steep side slopes at higher elevations, Wideman soils on flood plains, and Britwater soils on terraces. Sandstone and limestone outcrops and escarpments are included.

The soils in this map unit are mainly used as pasture or woodland. Portia soils in most gently sloping to moderately sloping areas have been cleared and are used for pasture or are idle. The stony Estate and Moko soils are in mixed hardwoods, pine, and cedar.

The stony Estate and Moko soils are not suited to cultivated crops. Estate soils are poorly suited to improved pasture. Moko soils are not suited to improved pasture. Portia soils are moderately suited to poorly suited to cultivated crops and are well suited to improved pasture. Estate and Portia soils are moderately suited to woodland use, and Moko soils are poorly suited. Estate and Moko soils are poorly suited to most urban uses because of slope, depth to bedrock, slow permeability, and surface stones. Low strength is a limitation for local roads and streets. These limitations are often difficult or impractical to overcome on these soils. Portia soils are moderately suited to most urban uses because of slope and moderate permeability. Low strength is a limitation for local roads and streets.

areas dominated by deep, gently sloping to steep soils; on side slopes and ridgetops

The soils in these areas make up about 9 percent of Baxter County. They are in the southern part of the county. The soils are loamy and very cherty. They formed in material that weathered from cherty limestone on the Springfield Plateau.

9. Clarksville-Nixa-Noark

Deep, gently sloping to steep, somewhat excessively drained, moderately well drained, and well drained, very cherty soils that formed in residuum of cherty limestone

These soils are in the southern part of Baxter County. They are on side slopes and ridgetops of the highly dissected Springfield Plateau.

This map unit makes up about 9 percent of the county. Clarksville soils make up about 48 percent of the unit,

Nixa soils make up 21 percent, Noark soils make up 20 percent, and soils of minor extent make up the rest.

The soils in this unit are very cherty and are underlain by cherty limestone bedrock. Clarksville soils are somewhat excessively drained. They are on steep side slopes. They have a surface layer of dark grayish brown very cherty silt loam. The subsoil is strong brown very cherty silt loam, and red very cherty silty clay.

Nixa soils are gently sloping to moderately sloping and are moderately well drained. They are on ridgetops. They have a surface layer of very dark grayish brown very cherty silt loam. The subsoil in the upper part is light yellowish brown very cherty silt loam. The middle part is a compact and brittle fragipan of yellowish brown, mottled very cherty silt loam. The lower part is mottled, yellowish red, strong brown, and light brownish gray very cherty silty clay loam.

Noark soils are gently sloping to steep and are well drained. They are on ridges and side slopes. Noark soils have a surface layer of dark grayish brown very cherty silt loam. The subsoil is yellowish red very cherty silt loam and red very cherty silty clay.

The minor soils in this map unit are Arkana and Moko soils on slightly lower elevations, Razort and Elsay soils on flood plains, and Britwater soils on stream terraces.

The soils of this map unit, in the gently sloping to moderately sloping areas, are used mainly for pasture. In steep areas they are used mainly as woodland. The trees are mixed hardwoods and pines. Originally, these soils, in most areas, were in mixed hardwoods and pines.

The steep Clarksville soils are not suited to cultivated crops or improved pasture because of slope. Nixa and Noark soils are poorly suited or not suited to cultivated crops. Slope, erosion hazard, and a high chert content are the main limitations of these soils for farming and most other uses. Nixa and Noark soils are moderately suited to not suited to improved pasture, depending on slope. The steep Clarksville soils and steep areas of Noark soils are poorly suited to most urban uses because of slope. This limitation is often difficult or impractical to overcome on these soils. The gently sloping to moderately sloping areas of Nixa and Noark soils are moderately suited to most urban uses because of slope. Some areas of these soils have slow permeability, which is a limitation that is often difficult to overcome.

areas dominated by shallow and deep, gently sloping to steep soils; on mountaintops and side slopes

The soils in these areas make up about 1 percent of Baxter County. They are in the extreme southwestern part of the county. The soils are loamy and stony. They formed in material that weathered from sandstone on outliers of the Boston Mountains.

10. Mountainburg-Sidon

Shallow and deep, gently sloping to steep, well drained and moderately well drained, stony and loamy soils that formed in residuum of acid sandstone

These soils are in the extreme southwestern part of Baxter County on an outlier of the Boston Mountains. They are on mountaintops and side slopes.

This soil unit makes up about 1 percent of the county. Mountainburg soils make up about 55 percent of this unit, Sidon soils make up 41 percent, and soils of minor extent make up the rest.

Mountainburg soils are shallow and well drained. They are on gently sloping mountaintops and steep side slopes. They have a surface layer of dark grayish brown gravelly loam or very stony sandy loam. The subsoil is strong brown, very gravelly sandy clay loam. Below the subsoil there is hard, level-bedded acid sandstone bedrock.

Sidon soils are deep and moderately well drained. They are on broad gently sloping mountaintops. The surface layer is yellowish brown silt loam. The subsoil in the upper part is strong brown silty clay loam. The middle part is a fragipan of yellowish brown silt loam and a mottled, strong brown, gray, and red gravelly clay loam. The lower part is mottled gray, strong brown, and red very gravelly clay loam. Below the subsoil there is hard, level-bedded acid sandstone.

The minor soils in this map unit are the very cherty Clarksville and Noark soils on steep side slopes at lower elevations.

The soils in the gently sloping areas of this unit mainly have been cleared and are used for pasture and hay. The steeper areas of the stony Mountainburg soils are in mixed upland hardwoods. Originally, these soils, in most areas, were in hardwood forest. Small areas of prairie vegetation were intermingled with the trees on the gently sloping areas.

Mountainburg soils are not suited to cultivated crops. They are poorly suited to pasture and woodland. Sidon soils are moderately suited to cultivated crops, pasture, and woodland. Mountainburg soils are poorly suited to most urban uses because of surface stones, slope, and depth to bedrock. These limitations are difficult and often impractical to overcome. Sidon soils are moderately suited to most urban uses because of slope and slow permeability. Low strength is a limitation for local roads and streets. Generally, these limitations can be overcome on these soils.

soil descriptions—Marion County

areas dominated by deep, moderately deep, and shallow, gently sloping to steep soils; on ridgetops, side slopes, and broad uplands

The soils in these areas make up about 38 percent of Marion County. They are in the central and northern

parts of the county. The soils are loamy and are cherty, very cherty, or stony. They formed in material that weathered from level-bedded dolomite on the Salem Plateau.

1. Arkana-Moko

Moderately deep and shallow, gently sloping to steep, well drained, cherty and stony soils that formed in residuum of dolomite and limestone

These soils are in the northern and central parts of Marion County. They are on side slopes and ridgetops on the Salem Plateau.

This map unit makes up about 25 percent of the county. Arkana soils make up about 46 percent of the unit, Moko soils make up 38 percent, and soils of minor extent make up 16 percent.

Arkana and Moko soils generally are intermingled on the same landscape. Both soils are well drained. Arkana soils are moderately deep, and Moko soils are shallow. Arkana soils have a surface layer of very dark grayish brown and dark brown very cherty silt loam. The subsurface layer is brown very cherty silt loam. The subsoil is yellowish red very cherty silty clay, yellowish red cherty clay, and dark yellowish brown clay. The underlying material is hard dolomite bedrock. Moko soils consist of very dark brown and very dark grayish brown, very stony silt loam about 12 inches thick overlying hard dolomite bedrock.

The minor soils in this map unit are the Gassville, Nixa, and Doniphan soils on a landscape similar to that of Arkana and Moko soils. These soils are intermingled with areas of Rock outcrop. Razort and Elsah soils along drainageways also are minor soils.

The soils in this map unit are used mainly as woodland. The trees are redcedar and low grade hardwoods. In some of the gently sloping areas that have been cleared, the soils are used for pasture. Originally, these soils, in most areas, were in open stands of hardwoods and redcedar. Prairie plants grew in the openings.

Arkana and Moko soils are not suited to cultivated crops. Depth to bedrock, surface stones, the hazard of erosion, and slope are the main limitations to use of these soils for farming and most other uses. Arkana soils are poorly suited to pasture and to use as woodland. Moko soils are not suited to improved pasture and poorly suited to use as woodland. These soils are poorly suited to most urban uses because of the slope, high shrink-swell potential, and depth to bedrock. Low soil strength is a limitation for local roads and streets. These limitations are difficult and in most places impractical to overcome.

2. Doniphan-Gassville

Deep and moderately deep, moderately sloping to steep, well drained, very cherty soils that formed in residuum of cherty dolomite

These soils are scattered throughout the central and northern parts of Marion County. They are on uplands on the Salem Plateau.

This unit makes up about 9 percent of the county. Doniphan soils make up about 68 percent of the unit, Gassville soils make up 22 percent, and soils of minor extent make up the rest.

Doniphan soils are deep and well drained. They are on moderately sloping uplands. They have a surface layer of dark brown very cherty silt loam. The subsoil is strong brown very cherty silt loam, yellowish red, mottled cherty silty clay, and dark red and mottled dark red, strong brown, and light gray clay.

Gassville soils are moderately deep and well drained. They are on steep side slopes. They have a surface layer of dark brown very cherty silt loam. The subsoil is strong brown very cherty silt loam, yellowish red cherty clay, and mottled yellowish brown and red clay. Below the subsoil there is highly fractured soft, ripplable siltstone over hard, level-bedded dolomite bedrock.

The minor soils in this map unit are the very cherty Nixa soils on a landscape similar to that of Doniphan soils and the very cherty Arkana and stony Moko soils on a landscape similar to that of Gassville soils. Also included are very small areas of Razort and Elsah soils along drainageways.

The soils in this map unit are used mainly for pasture and woodland. Doniphan soils, in most of the less sloping areas, have been cleared and are used for pasture. The steep Gassville soils are mainly in low grade upland hardwoods. Originally, these soils, in most areas, were in hardwood forest.

The soils of this map unit are not suited to cultivated crops. Slope, erosion hazard, depth to bedrock, slow permeability, and surface chert are the main limitations of these soils for farming and most other uses.

Doniphan soils are moderately suited and Gassville soils are poorly suited to improved pasture. Doniphan and Gassville soils are moderately suited to use as woodland. Doniphan soils are poorly suited to most urban uses because of slope and moderate permeability. Low strength is a limitation for local roads and streets. These limitations are generally difficult to overcome on these soils. Gassville soils are poorly suited to most urban uses because of slope, depth to bedrock, and slow permeability. Low strength is a limitation for local roads and streets. These limitations are difficult and often impractical to overcome on these soils.

3. Nixa-Doniphan

Deep, gently sloping to moderately sloping, moderately well drained and well drained, very cherty soils that formed in residuum of cherty dolomite

These soils are primarily in the east central part of Marion County. These soils are on ridgetops and on undulating to rolling uplands on the Salem Plateau.

This map unit makes up about 4 percent of the county. Nixa soils make up about 48 percent of the unit,

Doniphan soils make up 46 percent, and soils of minor extent make up the rest.

Nixa soils are moderately well drained. They are on ridges and uplands. They have a surface layer of very dark grayish brown very cherty silt loam. The subsoil in the upper part is light yellowish brown very cherty silt loam. The lower part is mottled, yellowish red, strong brown, and light brownish gray cherty silty clay loam.

Doniphan soils are well drained. They are on uplands. They have a surface layer of dark brown very cherty silt loam. The subsoil is strong brown very cherty silt loam, yellowish red, mottled cherty silty clay, and dark red and mottled, dark red, strong brown, and light gray clay.

The minor soils in this map unit are Arkana and Moko soils on a landscape similar to that of the Nixa and Doniphan soils, and Gassville soils on steep side slopes.

The soils in this map unit are mainly used for pasture. Originally, these soils, in most areas, were in open stands of mixed upland hardwoods.

Doniphan and Nixa soils are poorly suited to not suited to cultivated crops, depending on slope. Slope, high chert content, erosion hazard, and slow permeability are the main limitations of these soils for farming and most other uses. They are moderately suited to improved pasture and woodland. The soils are moderately suited to poorly suited for most urban uses because of slope and moderate permeability. Low strength is a limitation for local roads and streets. Most of these limitations can be overcome on these soils. Some areas have slow permeability, which is often difficult to overcome.

areas dominated by deep, nearly level to steep soils; on ridgetops, side slopes, and broad uplands

The soils in these areas make up about 29 percent of Marion County. They are in the west central and southern parts of the county. The soils are loamy and very cherty. They formed in material that weathered from cherty limestone on the Springfield Plateau.

4. Clarksville-Noark-Nixa

Deep, gently sloping to steep, somewhat excessively drained, well drained, and moderately well drained, very cherty soils that formed in residuum of cherty limestone

The soils are in the west central and southern part of Marion County. They are on side slopes and ridgetops of the highly dissected Springfield Plateau.

This map unit makes up about 27 percent of the county. Clarksville soils make up about 45 percent of the unit, Noark soils make up 25 percent, Nixa soils make up 22 percent, and soils of minor extent make up the rest.

The soils in this unit are very cherty and are underlain by cherty limestone bedrock. Clarksville soils are somewhat excessively drained. They are on steep side slopes. They have a surface layer of dark grayish brown very cherty silt loam. The subsoil is strong brown very cherty silt loam, yellowish red very cherty silty clay loam, and red very cherty silty clay.

Noark soils are gently sloping to steep and well drained. They are on ridgetops and side slopes. They have a surface layer of dark grayish brown very cherty silt loam. The subsoil is yellowish red very cherty silt loam, and red very cherty silty clay.

Nixa soils are gently sloping to moderately sloping and are moderately well drained. They are on ridgetops. They have a surface layer of very dark grayish brown very cherty silt loam. The upper part of the subsoil is light yellowish brown very cherty silt loam. The middle part is a compact and brittle fragipan of yellowish brown, mottled, very cherty silt loam. The lower part is mottled, yellowish red, strong brown, and light brownish gray very cherty silty clay loam.

The minor soils in this map unit are the Arkana, Estate, and Moko soils at slightly lower elevations and the Elsah soils on flood plains.

The soils in the gently sloping to moderately steep areas of this map unit are mainly used for pasture, and those in most steep areas are used as woodland of mixed hardwoods and pines. Originally, these soils, in most areas, were in mixed hardwoods and pines.

The steep Clarksville soils are not suited to cultivated crops or improved pasture because of slope. Noark and Nixa soils are poorly suited or not suited to cultivated crops. Slopes, erosion hazard, and high chert content are the main limitations of these soils for farming and most other uses. Noark and Nixa soils are moderately suited to not suited to improved pasture, depending on slope. These soils are moderately suited to woodland. The steep Clarksville soils and steep areas of Noark soils are poorly suited to most urban uses because of slope. This limitation is often difficult or impractical to overcome on these soils. The gently sloping to moderately sloping areas of Noark and Nixa soils are moderately suited to most urban uses because of slope. This limitation can usually be overcome on these soils. Some areas have slow permeability, which is a limitation that is often difficult to overcome.

5. Nixa-Tonti-Captina

Deep, nearly level to moderately sloping, moderately well drained, loamy and very cherty soils that formed in loamy material over limestone

These soils are mostly in the southwestern part of Marion County and around the community of Lakeway. They are on broad uplands on the Springfield Plateau.

This unit makes up about 2 percent of the county. Nixa soils make up about 48 percent of the unit, Tonti soils make up 30 percent, Captina soils make up 15 percent, and soils of minor extent make up the rest.

The very cherty Nixa soils are gently sloping to moderately sloping. They have a surface layer of very dark grayish brown very cherty silt loam. The subsoil in the upper part is light yellowish brown very cherty silt loam. The middle part is a compact and brittle fragipan of yellowish brown, mottled, very cherty silt loam. The

lower part is mottled, yellowish red, strong brown, and light brownish gray very cherty silty clay loam.

The cherty Tonti soils are gently sloping. They have a surface layer of brown cherty silty loam. The subsoil in the upper part is strong brown cherty silt loam. The middle part is a compact and brittle fragipan of strong brown, mottled, very cherty silt loam. The lower part is red clay.

Captina soils are nearly level to gently sloping. They have a surface layer of dark brown silt loam. The subsoil in the upper part is yellowish brown and strong brown silty clay loam. The middle part is a compact and brittle fragipan of mottled, strong brown, light gray, yellowish red, and yellowish brown cherty and very cherty silty clay loam.

The minor soils in this map unit are the very cherty Noark and Clarksville soils.

The soils in this unit are used mainly for pasture and hay. Originally, the soils, in most areas, were in scattered hardwoods. There was an understory of tall grasses.

Captina and Tonti soils are well suited to moderately suited and Nixa soils are poorly suited to cultivated crops. Surface chert, slope, erosion hazard, and slow permeability are moderate limitations of these soils for farming and other uses. Captina and Tonti soils are well suited and Nixa soils are moderately suited to pasture. These soils are moderately suited to woodland use. These soils are well suited to moderately suited to most urban uses. Slope, low strength, and wetness are limitations that can usually be overcome on these soils. Low strength is a limitation only for local roads and streets. Most areas have slow permeability, which is a limitation that is often difficult to overcome.

areas dominated by deep, level to gently sloping soils; on flood plains and stream terraces

The soils in these areas make up about 4 percent of Marion County. They are along Crooked Creek, Sugarloaf Creek, Buffalo River, and White River. The soils are loamy and sandy. They formed in alluvial sediment.

6. Razort-Britwater-Wideman

Deep, level to gently sloping, well drained and excessively drained, loamy and sandy soils that formed in alluvium

These soils are on flood plains and terraces along Crooked Creek, Sugarloaf Creek, Buffalo River, and White River.

This map unit makes up about 4 percent of Marion County. Razort soils make up about 27 percent of the map unit, Britwater soils make up 24 percent, Wideman soils make up 22 percent, and soils of minor extent make up 27 percent.

Razort soils are well drained. They are on flood plains and are frequently flooded. They have a surface layer of dark brown silt loam. The subsoil is dark brown loam,

dark brown yellowish brown gravelly loam, and dark brown silty clay loam. Below the subsoil there is brown very gravelly loamy sand.

Britwater soils are well drained. They are on stream terraces. They have a surface layer of dark yellowish brown silt loam or gravelly silt loam. The subsoil is dark brown silt loam or gravelly silt loam, yellowish red silty clay loam or gravelly silty clay loam, and red gravelly silty clay loam, gravelly clay loam, and very gravelly silty clay.

Wideman soils are excessively drained. They are on flood plains and are frequently flooded. They have a surface layer of dark yellowish brown sandy loam. The underlying material is yellowish brown and pale brown loamy sand, fine sandy loam, and sand.

The minor soils in this map unit are Healing soils and Doniphan soils, which are on upland side slopes. Gravel bars and areas of sandy and gravelly overwash are included.

The soils in this map unit are used mainly for pasture and hay, but for 60 to 90 years much of the acreage was cultivated. Originally, these soils, in most areas, were in a dense stand of mixed hardwoods.

Razort and Wideman soils are poorly suited to cultivated crops because flooding is a severe hazard. Britwater soils are well suited to moderately suited to cultivated crops, depending on slope. Flooding and erosion are the main limitations of these soils for farming and for most other uses. Razort and Britwater soils are well suited to pasture, and Wideman soils are moderately suited. Razort soils are well suited to use as woodland, and Britwater and Wideman soils are moderately suited. Razort and Wideman soils are poorly suited to most urban uses because of the severe flood hazard. Flood retarding structures are necessary to overcome this limitation. Britwater soils are well suited to moderately suited to most urban uses because of slope and moderate permeability. Low strength is a limitation for local roads and streets.

areas dominated by deep and shallow, gently sloping to steep soils; on side slopes, foot slopes, and rolling uplands

The soils in these areas make up about 29 percent of Marion County. They are in the southern part of the county. The soils are loamy and stony. They formed in material weathered from sandstone or interbedded sandstone and limestone on the Salem Plateau and at lower elevations of the Springfield Plateau.

7. Portia-Estate

Deep, gently sloping to moderately sloping, well drained, loamy and stony soils that formed in residuum of interbedded sandstone and limestone

These soils are in the southern part of Marion County. They are mainly around the communities of Ralph and Pyatt. These soils are on side slopes, foot slopes, and rolling uplands.

This map unit makes up about 2 percent of the county. Portia soils make up about 68 percent of the unit, Estate soils make up 22 percent, and soils of minor extent make up the rest.

Portia soils are well drained. They are on uplands and foot slopes. They have a surface layer of brown fine sandy loam. The subsoil is dark brown sandy loam, reddish brown sandy clay loam, and red sandy clay loam.

Estate soils are stony and well drained. They are on uplands and side slopes. They have a surface layer of dark grayish brown stony sandy loam. The subsoil is yellowish red sandy loam, yellowish red clay loam, and red clay.

The minor soils in this map unit are Moko soils on a landscape similar to that of Portia and Estate soils and small areas of very cherty Clarksville and Noark soils on side slopes at higher elevations.

The soils in this map unit are used mainly for pasture. Originally, these soils, in most areas, were in mixed upland hardwoods. Slope, surface stones, and an erosion hazard are the main limitations of these soils for farming and most other uses.

Portia soils are moderately suited to poorly suited to cultivated crops. The stony Estate soils are not suited to cultivated crops. Portia soils are well suited to pasture, and Estate soils are poorly suited. Portia and Estate soils are moderately suited to woodland use. Portia soils are moderately suited to most urban uses because of slope and moderate permeability. Low strength is a limitation for local roads and streets. These limitations can usually be overcome on these soils. Estate soils are poorly suited to residential and community development uses because of slope, surface stones, depth to bedrock, and slow permeability. These limitations are often difficult or impractical to overcome on these soils.

8. Portia-Estate-Moko

Deep and shallow, gently sloping to steep, well drained, loamy and stony soils that formed in residuum and colluvium of interbedded sandstone and limestone

These soils are mainly in the southern part of Marion County. They are on gently sloping to rolling uplands on the Salem Plateau and, at lower elevations, on gently sloping to moderately sloping foot slopes and steep side slopes on the Springfield Plateau.

This map unit makes up about 27 percent of the county. Portia soils make up about 30 percent of the unit, Estate soils make up 25 percent, Moko soils make up 16 percent, and soils of minor extent make up 29 percent.

Portia soils are on foot slopes. They have a surface layer of brown fine sandy loam. The subsoil is dark brown sandy loam, reddish brown sandy clay loam, and red sandy clay loam.

Estate soils are on steep side slopes at higher elevations. They have a surface layer of dark grayish

brown stony sandy loam. The subsoil is yellowish red sandy loam, yellowish red clay loam, and red clay.

Moko soils are on side slopes. They consist of very dark brown and very dark grayish brown stony silt loam about 12 inches thick overlying hard limestone bedrock.

The minor soils in this map unit are very cherty Clarksville and Noark soils on steep side slopes at higher elevations and Razort, Wideman, and Britwater soils on flood plains and terraces. Sandstone and limestone outcrop and escarpments are part of the unit.

The soils in this map unit are used mainly as pasture or woodland. In most gently sloping to moderately sloping areas, Portia soils have been cleared and are used for pasture or are idle. The stony Estate and Moko soils are in stands of mixed hardwoods, pine, and cedar.

The stony Estate and Moko soils are not suited to cultivated crops. Slope, surface stones, rock outcrop, and an erosion hazard are the main limitations of these soils for farming and most other uses. Portia soils are moderately suited to poorly suited to cultivated crops and well suited to improved pasture. Estate soils are poorly suited to improved pasture, and Moko soils are not suited. Portia and Estate soils are moderately suited to woodland use, and Moko soils are poorly suited. Estate and Moko soils are poorly suited to most urban uses because of slow permeability, slope, depth to bedrock, and surface stones. Low strength is a limitation for local roads and streets. Portia soils are moderately suited to most urban uses because of slope and moderate permeability. Low strength is a limitation for local roads and streets.

broad land use considerations

Baxter and Marion Counties are two of the fastest growing counties in the Arkansas Ozarks. Many retirees have migrated to the two counties, mainly to enjoy the two multipurpose reservoirs in the area. As the population grows, the demand for land and the demands put on the land will continue to increase.

The map units in Baxter and Marion Counties vary widely in their suitability for agricultural and urban uses. The ratings of soil suitability reflect the cost of measures needed to overcome limitations and the problems that occur after these measures have been taken. They also point out limitations that are difficult and often impractical to overcome. The ratings do not consider distance to existing transportation systems or other kinds of facilities.

Each map unit is rated for cultivated crops, pasture, woodland use, and urban uses. The ratings for cultivated crops indicate suitability for row crops, home gardens, orchards, lawns, flowers, and shrubs. Pasture is land in improved grasses such as tall fescue or bermudagrass; woodland is land supporting a stand of trees. The ratings for pasture and woodland indicate potential productivity and the cost of establishing and maintaining grass or trees. Urban uses include residential, commercial, and

industrial land uses, roads and streets, and sanitary facilities.

cultivated crops

Parts of the Captina-Tonti-Nixa and Healing-Razort-Britwater map units in Baxter County and parts of the Nixa-Tonti-Captina and Razort-Britwater-Wideman map units in Marion County are well suited to cultivated crops if conservation practices are used to control erosion. The remainder of these map units is moderately suited to poorly suited to cultivated crops. Parts of the Brockwell-Portia and Mountainburg-Sidon map units in Baxter County and parts of the Portia-Estate and Portia-Estate-Moko map units in Marion County are moderately suited to cultivated crops. The remainder of the map units in the two counties is poorly suited or not suited to cultivated crops. Steep slope, coarse fragments, erosion, and depth to bedrock are the main limitations to use of these soils for cultivated crops.

pasture

All of the Brockwell-Portia and Healing-Razort-Britwater map units and parts of the Captina-Tonti-Nixa and Mountainburg-Sidon map units in Baxter County and parts of the Portia-Estate, Portia-Estate-Moko, Razort-Britwater-Wideman, Nixa-Tonti-Captina, and Clarksville-Noark-Nixa map units in Marion County are well suited to pasture. The remainder of these units is moderately suited to not suited to improved pasture. The steep areas of the Arkana-Moko, Clarksville-Nixa-Noark, Doniphan-Gassville, Estate-Portia-Moko, and Mountainburg-Sidon map units in Baxter County and the Arkana-Moko, Clarksville-Noark-Nixa, Doniphan-Gassville, and Portia-Estate-Moko map units in Marion County are generally not suited to improved pasture. The remainder of these units, as well as the Doniphan-Ventris and Doniphan-Nixa map units in Baxter County and the Nixa-Doniphan map units in Marion County, is moderately suited to poorly suited to pasture. Steep

slopes, surface stones, and depth to bedrock are the main limitations to use of these soils for pasture.

woodland

Parts of the Healing-Razort-Britwater map unit in Baxter County and part of the Razort-Britwater-Wideman map unit in Marion County are well suited to use as woodland. The Arkana-Moko map units in Baxter and Marion Counties are poorly suited to use as woodland. The rest of the two counties is moderately suited to poorly suited to use as woodland. Slope and surface stones are severe limitations for logging equipment in many areas of the two counties. In some areas tree growth is slow because of low water holding capacity caused by shallow depth to bedrock, coarse fragments, or plastic clay subsoil.

urban uses

Large areas are being developed for urban uses. They are mainly along the major transportation corridors, around the reservoirs, along the White River, and surrounding the cities of Yellville, Flippin, and Bull Shoals in Marion County and the cities of Cotter, Gassville, Mountain Home, and Lakeview in Baxter County. Parts of the Healing-Razort-Britwater and Brockwell-Portia map units in Baxter County and parts of the Razort-Britwater-Wideman and Portia-Estate map units in Marion County are well suited to urban uses.

The rest of the two counties is moderately suited to poorly suited to urban uses. Most of the soils are severely limited for urban use because of slow permeability, shallowness to bedrock, a high shrink-swell potential, frequent flooding, steep slopes, or a combination of these limitations. Some of the soils have low strength, which is a limitation for local roads and streets. Some of these limitations are difficult and often impractical to overcome; others may be overcome by proper engineering design and careful installation. Generally speaking, the soils well suited to urban uses are also well suited to cultivated crops and other agricultural uses.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Nixa very cherty silt loam, 3 to 8 percent slopes is one of several phases in the Nixa series.

Some map units are made up of two or more major soils. These map units are called soil complexes, soil associations, or undifferentiated groups.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Arkana-Moko complex, 8 to 20 percent slopes, is an example.

A *soil association* is made up of two or more geographically associated soils that are shown as one unit on the maps. Because of present or anticipated soil uses in the survey area, it was not considered practical or necessary to map the soils separately. The pattern and relative proportion of the soils are somewhat similar. Estate-Portia-Moko association, steep, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in a mapped area are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 6 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

soil descriptions

1—Arkana very cherty silt loam, 3 to 8 percent slopes. This is a moderately deep, well drained, gently sloping soil on uplands. Slopes are smooth and convex. Individual areas range from about 5 to 30 acres in size.

Typically, the surface layer is very dark grayish brown very cherty silt loam about 4 inches thick. The next layer is dark brown very cherty silt loam to a depth of about 7 inches. The subsurface layer is brown very cherty silt loam to a depth of 11 inches. The subsoil is yellowish red very cherty silty clay to a depth of about 15 inches; yellowish red, mottled cherty clay to a depth of about 21 inches; and dark yellowish brown clay to a depth of 27 inches. Below the subsoil there is hard, level-bedded dolomite bedrock.

This soil is low in natural fertility and moderate in content of organic matter. It is medium acid to mildly alkaline in the surface layer and strongly acid to moderately alkaline in the subsoil. Permeability is very

slow, and the available water capacity is low. Tillth is difficult to maintain, and the very cherty surface limits the use of some tillage implements. The root zone is moderately deep; the clayey subsoil restricts root penetration.

Included with this soil in mapping are areas of similar soils except that they are lighter in color and have less chert in the surface layer or they are deeper than 40 inches to bedrock. Also included are small areas of Gassville, Moko, and Ventris soils.

The soil in this unit is poorly suited to cultivated crops. Runoff is medium, but erosion is a very severe hazard if cultivated crops are grown. With management that includes minimum tillage, contour cultivation, and terraces, crops that leave large amounts of residue can be grown occasionally in a cropping system that keeps close-growing cover on the soil most of the time. This soil is used mainly for low grade hardwoods and cedar or pasture. It is poorly suited to pasture. Tall fescue, orchardgrass, lespedeza, and white clover are the only adapted pasture plants.

This soil is poorly suited to use as woodland. The only adapted trees are eastern redcedar and shortleaf pine. Seedling mortality is moderate.

Arkana soils have severe limitations for most urban uses. Low strength and high shrink-swell potential are severe limitations for roads and streets. The high shrink-swell potential is a severe limitation for dwellings and small commercial buildings. The limitations can generally be overcome by proper engineering design and installation. The very slow permeability and shallowness to rock are severe limitations for septic tank absorption fields. These limitations are difficult or impractical to overcome.

The capability unit is IVe-1. The woodland suitability group is 5c8.

2—Arkana-Moko complex, 3 to 8 percent slopes.

This complex consists of Arkana and Moko soils on ridges and gently sloping uplands. The slopes are uneven and complex. The areas of this complex range from about 10 to 50 acres in size. The areas of the individual soils range from about one-half to 4 acres in size. The soils in this complex are so intermingled that they could not be separated at the scale selected for mapping.

Arkana soils make up about 55 percent of each mapped area. Typically, the surface layer of Arkana soils is very dark grayish brown very cherty silt loam about 4 inches thick. The next layer is dark brown very cherty silt loam to a depth of about 7 inches. The subsurface layer is brown very cherty silt loam to a depth of 11 inches. The subsoil is yellowish red very cherty silty clay to a depth of 15 inches; yellowish red, mottled cherty clay to a depth of 21 inches; and dark yellowish brown clay to a depth of 27 inches. Below the subsoil there is hard, level-bedded dolomite bedrock.

Arkana soils are low in natural fertility and moderate in content of organic matter. They are medium acid to

mildly alkaline in the surface layer and strongly acid to moderately alkaline in the subsoil. The permeability is very slow, and the available water capacity is low. The root zone is moderately deep; the clayey subsoil restricts root penetration.

Moko soils make up about 40 percent of each mapped area. In a typical area of Moko soil, very dark brown and very dark grayish brown very stony silt loam about 12 inches thick overlies hard, level-bedded dolomite.

Moko soils are moderate in natural fertility and in content of organic matter. They are neutral or mildly alkaline throughout. The permeability is moderate, and the available water capacity is very low.

The remaining 5 percent of this complex consists of areas of Rock outcrop, Ventris soils, and soils that are similar to Arkana soils but are deeper than 40 inches to bedrock.

The soils making up this complex are not suited to cultivated crops. They are used mainly for low grade hardwoods and cedar or pasture. Arkana soils are poorly suited to pasture. Tall fescue, orchardgrass, lespedeza, and white clover are the only adapted pasture plants. Moko soils are not suited to pasture and should not be cleared of their native vegetation because erosion would be a severe hazard.

Arkana soils are poorly suited to woodland use. The only adapted trees are eastern redcedar and shortleaf pine. Seedling mortality is moderate. Moko soils also are poorly suited to woodland use. The best adapted species is eastern redcedar. The erosion hazard and seedling mortality are moderate, and the equipment limitation is severe.

Arkana soils have severe limitations for most urban uses. Low strength and high shrink-swell potential are severe limitations for roads and streets. The high shrink-swell potential is a severe limitation for dwellings and small commercial buildings. In most places, these limitations can be overcome by proper engineering design and installation. The very slow permeability and shallowness to rock are severe limitations for septic tank absorption fields. These limitations are difficult or impractical to overcome. Moko soils also have severe limitations for most urban uses. Shallowness to rock and large stones are severe limitations for dwellings, small commercial buildings, local roads and streets, and septic tank absorption fields. These limitations are difficult or impractical to overcome.

The capability unit is VIIs-1. The woodland suitability group is 5c8 for Arkana soils and 5x3 for Moko soils.

3—Arkana-Moko complex, 8 to 20 percent slopes.

This complex consists of Arkana and Moko soils on ridges and hillsides. The slopes are uneven and complex. The areas of this complex range from about 20 to 200 acres in size. The areas of the individual soils range from about 1 to 4 acres in size. They are so intermingled that they could not be separated at the scale selected for mapping.

Arkana soils make up about 50 percent of each mapped area. Typically, the surface layer of Arkana soils is very dark grayish brown very cherty silt loam about 4 inches thick. The next layer is dark brown very cherty silt loam to a depth of about 7 inches. The subsurface layer is brown very cherty silt loam to a depth of 11 inches. The subsoil is yellowish red very cherty silty clay to a depth of 15 inches; yellowish red, mottled cherty clay to a depth of 21 inches; and dark yellowish brown clay to a depth of 27 inches. Below the subsoil, there is hard, level-bedded dolomite bedrock.

Arkana soils are low in natural fertility and moderate in content of organic matter. They are medium acid to mildly alkaline in the surface layer and strongly acid to moderately alkaline in the subsoil. Permeability is very slow, and available water capacity is low. The root zone is moderately deep, but the clayey subsoil restricts root penetration.

Moko soils make up about 40 percent of each mapped area. Typically, the soil is very dark brown and very dark grayish brown very stony silt loam about 12 inches thick overlying hard, level-bedded dolomite bedrock.

Moko soils are moderate in natural fertility and in content of organic matter. They are neutral or mildly alkaline throughout. Permeability is moderate, and the available water capacity is very low.

The remaining 10 percent of this complex consists of areas of Doniphan, Gassville, and Ventris soils, areas of Rock outcrop, and soils that are similar to Arkana soils but are deeper than 40 inches to bedrock.

The soils making up this complex are not suited to cultivated crops. They are used mainly for low grade hardwoods and cedar or as pasture. Arkana soils are poorly suited to pasture. Adapted pasture plants include tall fescue, orchardgrass, lespedeza, and white clover. Moko soils are not suited to pasture and should not be cleared of their native vegetation because erosion would be a very severe hazard.

Arkana soils are poorly suited to woodland use. Eastern redcedar and shortleaf pine are the only adapted species. Equipment limitations and seedling mortality are moderate. Moko soils are poorly suited to woodland use. The main adapted species is eastern redcedar. Equipment limitations, seedling mortality, and the hazard of erosion are severe.

Arkana soils have severe limitations for most urban uses. Low strength and high shrink-swell potential are severe limitations for roads and streets. The high shrink-swell potential is a severe limitation for dwellings. Slope and high shrink-swell potential are severe limitations for small commercial buildings. In most places, these limitations can be overcome by proper engineering design and installation. The very slow permeability and depth to rock are severe limitations for septic tank absorption fields. These limitations are difficult or impractical to overcome. Moko soils also have severe limitations for most urban uses, such as dwellings, small commercial buildings, local roads and streets, and septic

tank absorption fields because of depth to rock and large stones. These limitations are difficult or impractical to overcome.

The capability unit is VIIIs-1. The woodland suitability group is 5c8 for Arkana soils and 5x3 for Moko soils.

4—Arkana-Moko complex, 20 to 40 percent slopes.

This complex consists of Arkana and Moko soils on steep hillsides. The slopes are uneven and convex, in many places having a stepped appearance caused by outcrops of horizontally bedded dolomite bedrock. The areas of this complex range from about 20 to 200 acres in size. The areas of the individual soils range from about 3 to 5 acres in size. They are so intermingled that they could not be separated at the scale selected for mapping.

Arkana soils make up about 45 percent of each mapped area. Typically, the surface layer of Arkana soils is very dark grayish brown very cherty silt loam about 4 inches thick. The next layer is dark brown very cherty silt loam to a depth of about 7 inches. The subsurface layer is brown very cherty silt loam to a depth of 11 inches. The subsoil is yellowish red very cherty silty clay to a depth of about 15 inches; yellowish red, mottled cherty clay to a depth of about 21 inches; and dark yellowish brown clay to a depth of about 27 inches. Below the subsoil, there is hard, level-bedded dolomite bedrock.

Arkana soils are low in natural fertility and moderate in content of organic matter. They are medium acid to mildly alkaline in the surface layer and strongly acid to moderately alkaline in the subsoil. Permeability is very slow, and the available water capacity is low. The root zone is moderately deep, but the clayey subsoil restricts root penetration.

Moko soils make up about 35 percent of each mapped area. Typically, the soil is very dark brown and very dark grayish brown very stony silt loam about 9 inches thick overlying hard, level-bedded dolomite bedrock.

Moko soils are moderate in natural fertility and in content of organic matter. They are neutral or mildly alkaline throughout. Permeability is moderate, and the available water capacity is very low.

The remaining 20 percent of this complex consists of Doniphan and Gassville soils, areas where the slopes are more than 40 percent, rock outcrops, and soils that are similar to Arkana soils but are deeper than 40 inches to bedrock.

The soils making up this complex are not suited to cultivated crops. They are used mainly for low grade hardwoods and redcedar and as wildlife habitat. These soils are not suited to pasture. They should not be cleared of their native vegetation because erosion would be a very severe hazard.

Arkana soils are poorly suited to use as woodland. The only adapted species are eastern redcedar and shortleaf pine. Equipment limitations and seedling mortality are severe, and erosion is a moderate hazard. Moko soils also are poorly suited to woodland use. The

best adapted species is eastern redcedar. The equipment limitations, the erosion hazard, and seedling mortality are severe.

Arkana soils have severe limitations for most urban uses. Slope, low strength, and high shrink-swell potential are severe limitations for dwellings and small commercial buildings. Very slow permeability, shallowness to rock, and slope are severe limitations for septic tank absorption fields. These limitations are difficult or impractical to overcome. Moko soils also have severe limitations for most urban uses. Shallowness to rock, large stones, and slope are severe limitations for dwellings, small commercial buildings, local roads and streets, and septic tank absorption fields. These limitations are difficult or impractical to overcome.

The capability unit is VIIIs-1. The woodland suitability group is 5c9 for Arkana soils and 5x3 for Moko soils.

5—Britwater silt loam, 1 to 3 percent slopes. This is a deep, well drained, nearly level soil on stream terraces. Slopes are smooth and convex. Individual areas range from about 10 to 40 acres in size.

Typically, the surface layer is dark yellowish brown silt loam about 7 inches thick. The subsoil is dark brown silt loam to a depth of about 14 inches; yellowish red silty clay loam to a depth of 24 inches; yellowish red gravelly silty clay loam to a depth of 33 inches; red, mottled gravelly silty clay loam to a depth of 50 inches; red, mottled gravelly clay loam to a depth of about 63 inches; and red very gravelly silty clay to a depth of 76 inches or more.

This soil is moderate in natural fertility and in content of organic matter. It is medium acid or strongly acid throughout, except where it has been limed. Permeability is moderate, and the available water capacity is high. Tilth is good, and the soil can be worked throughout a wide range of moisture content. The root zone is deep and easily penetrated.

Included with this soil in mapping are small areas where the soil is gravelly and small areas of Healing and Razort soils.

The soil in this unit is well suited to cultivated crops. Adapted crops include corn, soybeans, small grains, and truck crops. Runoff is medium. Erosion is a moderate hazard and is the main limitation if cultivated crops are grown. With management that includes contour cultivation and terraces on long slopes, clean tilled crops that leave large amounts of residue can be safely grown year after year. Conservation treatment needs to be intensified as the length and grade of the slope increase. This soil responds well to fertilizer, and tilth is easily maintained by returning crop residue to the soil. This soil is well suited to pasture. It is used mainly for pasture and hay. Adapted pasture plants include bermudagrass, tall fescue, white clover, and lespedeza.

This soil is well suited to use as woodland. Shortleaf pine, loblolly pine, red oak, and eastern redcedar are adapted species. There are no significant limitations to woodland use and management.

There are no significant limitations for dwellings and small commercial buildings. Low soil strength is a moderate limitation for roads and streets. This limitation can be overcome by proper engineering design and careful installation. The moderate permeability is a moderate limitation for septic tank absorption fields. This limitation can be overcome in most places by increasing the size of the absorption field.

The capability unit is IIe-1. The woodland suitability group is 3o7.

6—Britwater silt loam, 3 to 8 percent slopes. This is a deep, well drained, gently sloping soil on stream terraces and uplands. Slopes are smooth and convex. Individual areas range from about 10 to 60 acres in size.

Typically, the surface layer is dark yellowish brown silt loam about 7 inches thick. The subsoil is dark brown silt loam to a depth of about 14 inches; yellowish red silty clay loam to a depth of 24 inches; yellowish red gravelly silty clay loam to a depth of 33 inches; red gravelly silty clay loam to a depth of 50 inches; red gravelly clay loam to a depth of 63 inches; and red very gravelly silty clay to a depth of 76 inches or more.

This soil is moderate in natural fertility and in content of organic matter. It is medium acid or strongly acid throughout, except for surface layers that have been limed. Permeability is moderate, and the available water capacity is high. Tilth is good, and the soil can be worked throughout a wide range of moisture content. The root zone is deep and easily penetrated.

Included with this soil in mapping are some areas where the soil is eroded and the A and B horizons have been mixed, small areas where the soil is gravelly, areas with slopes greater than 8 percent, and small areas of Doniphan, Healing, and Razort soils.

The soil in this unit is moderately suited to cultivated crops. Adapted crops include corn, soybeans, and small grains. Runoff is medium, but erosion is a severe hazard if cultivated crops are grown. With management that includes minimum tillage, terraces, and contour cultivation, crops that leave large amounts of residue can be safely grown year after year. Conservation treatment will need to be intensified as the length and grade of the slope increase. This soil is mainly used for pasture and hay. It is well suited to pasture. The pasture plants adapted to this soil include bermudagrass, tall fescue, white clover, and lespedeza.

This soil is well suited to woodland use. The species adapted to this soil include shortleaf pine, loblolly pine, red oak, and eastern redcedar. There are no significant limitations to woodland use and management.

There are no significant limitations for dwellings. Low strength is a moderate limitation for local roads and streets. Slope is a moderate limitation for small commercial buildings. In most places, these limitations can be overcome by proper engineering design and installation. Moderate permeability is a moderate limitation for septic tank absorption fields. In most

places, this limitation can be overcome by increasing the size of the absorption field.

The capability unit is IIIe-1. The woodland suitability is group 3o7.

7—Britwater gravelly silt loam, 3 to 8 percent slopes. This is a deep, well drained, gently sloping soil on stream terraces. Slopes are smooth and convex. Individual areas range from about 5 to 75 acres in size.

Typically, the surface layer is dark yellowish brown gravelly silt loam about 7 inches thick. The subsoil is dark brown gravelly silt loam to a depth of about 14 inches; yellowish red gravelly silty clay loam to a depth of 33 inches; red gravelly silty clay loam to a depth of 50 inches; red gravelly clay loam to a depth of 63 inches; and red very gravelly silty clay to a depth of 76 inches or more.

This soil is moderate in natural fertility and in content of organic matter. It is medium acid or strongly acid throughout, except for surface layers that have been limed. Permeability is moderate, and the available water capacity is high. Tilth is good, and the soil can be worked throughout a wide range of moisture content. Gravel slightly hinders tillage operations. The root zone is deep and easily penetrated by roots.

Included with this soil in mapping are some areas where the soil is eroded and the A and B horizons have been mixed, small areas where the soil is not gravelly, areas where the slope is greater than 8 percent, and small areas of Doniphan, Healing, and Razort soils.

The soil in this unit is moderately suited to cultivated crops. The crops adapted to this soil include corn, soybeans, and small grains. Runoff is medium, but erosion is a severe hazard if cultivated crops are grown. With management that includes minimum tillage, terraces, and contour cultivation, crops that leave large amounts of residue can be safely grown year after year. Conservation treatment needs to be intensified as the length and grade of the slope increase. The soil is used mainly for pasture and hay. It is well suited to pasture. The pasture plants adapted to this soil include bermudagrass, tall fescue, white clover, and lespedeza.

This soil is well-suited to use as woodland. The species adapted to this soil include shortleaf pine, loblolly pine, red oak, and eastern redcedar. There are no significant limitations to woodland use and management.

There are no significant limitations for dwellings. Low strength is a moderate limitation for local roads and streets. Slope is a moderate limitation for small commercial buildings. In most places, these limitations can be overcome by proper engineering design and installation. Moderate permeability is a moderate limitation for septic tank absorption fields. In most places, this limitation can be overcome by increasing the size of the absorption field.

The capability unit is IIIe-1. The woodland suitability group is 3o7.

8—Brockwell sandy loam, 3 to 8 percent slopes.

This is a deep, well drained, gently sloping soil on broad upland areas. Slopes are smooth and convex. Individual areas range from about 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown sandy loam about 5 inches thick. The subsurface layer is brown sandy loam to a depth of about 9 inches. The subsoil is strong brown sandy loam to a depth of 13 inches; strong brown fine sandy loam to a depth of 28 inches; strong brown and pale brown fine sandy loam to a depth of 60 inches; mottled strong brown, pale brown, and red sandy clay loam to a depth of 72 inches or more.

This soil is low in natural fertility and in content of organic matter. It is medium acid to very strongly acid throughout, except where the surface layer has been limed. Permeability is moderate, and the available water capacity is medium. Tilth is good, and the soil can be worked throughout a wide range of moisture content. The root zone is deep and easily penetrated by roots.

Included with this soil in mapping are small areas where the surface layer is gravelly, where the soil is stony, or where bedrock is at a depth of less than 60 inches. Also included are small areas of Estate and Portia soils.

The soil in this unit is moderately suited to cultivated crops. The crops adapted to this soil include corn, small grains, and truck crops. Runoff is medium, but erosion is a severe hazard if cultivated crops are grown. With management that includes minimum tillage, contour cultivation, and terraces, crops that leave large amounts of residue can be safely grown year after year. Conservation treatment needs to be intensified as the length and grade of the slope increase. The soil is used mainly for hay and pasture. It is well suited to pasture. The pasture plants adapted to this soil include tall fescue, bahiagrass, white clover, bermudagrass, and lespedeza.

This soil is well suited to use as woodland. The only adapted species are shortleaf pine, loblolly pine, white oak, and red oak. There are no significant limitations to woodland use and management.

There are no significant limitations for dwellings, roads and streets, and septic tank absorption fields. Slope is a moderate limitation for small commercial buildings. In most places, this limitation can be overcome by engineering design and careful installation.

The capability unit is IIIe-2. The woodland suitability group is 3o7.

9—Brockwell gravelly sandy loam, 3 to 8 percent slopes. This is a deep, well drained, gently sloping soil on broad upland areas. Slopes are smooth and convex. Individual areas range from about 10 to 80 acres in size.

Typically, the surface layer is dark grayish brown gravelly sandy loam about 5 inches thick. The subsurface layer is brown gravelly sandy loam to a depth of about 9 inches. The subsoil is strong brown gravelly

sandy loam to a depth of about 13 inches; strong brown gravelly fine sandy loam to a depth of 28 inches; strong brown and pale brown gravelly fine sandy loam to a depth of 60 inches; and mottled strong brown, pale brown, and red sandy clay loam to a depth of 72 inches or more.

This soil is low in natural fertility and organic matter content. It is medium to very strongly acid throughout, except where the surface layer has been limed. Permeability is moderate, and the available water capacity is medium. Tilth is good, and the soil can be worked throughout a wide range of moisture content. Gravel is a slight hindrance to tillage operations. The root zone is deep and easily penetrated by roots.

Included with this soil in mapping are small areas where the soil is not gravelly, where the soil is stony, or where bedrock is at a depth of less than 60 inches. Also included are small areas of Estate and Portia soils.

The soil in this unit is moderately suited to cultivated crops. The crops adapted to this soil include corn, small grains, and truck crops. Runoff is medium, and erosion is a severe hazard if cultivated crops are grown. With management that includes minimum tillage, contour cultivation, and terraces, crops that leave large amounts of residue can be safely grown year after year. Conservation treatment needs to be intensified as the length and grade of the slope increase. This soil is used mainly for hay and pasture. It is well suited to pasture. The pasture plants adapted to this soil include tall fescue, bahiagrass, white clover, bermudagrass, and lespedeza.

This soil is well suited to woodland use. The species adapted to this soil include shortleaf pine, loblolly pine, white oak, and red oak. There are no significant limitations to woodland use and management.

There are no significant limitations for dwellings, roads and streets, and septic tank absorption fields. Slope is a moderate limitation for small commercial buildings. In most places, this limitation can be overcome by engineering design and careful installation.

The capability unit is 11e-2. The woodland suitability group is 3o7.

10—Brockwell gravelly sandy loam, 8 to 20 percent slopes. This is a deep, well drained, moderately sloping to moderately steep soil on rolling uplands and side slopes. Slopes are smooth and convex. Individual areas range from about 10 to 150 acres in size.

Typically, the surface layer is dark grayish brown gravelly sandy loam about 5 inches thick. The subsurface layer is brown gravelly sandy loam to a depth of about 9 inches. The subsoil is strong brown gravelly sandy loam to a depth of about 13 inches; strong brown gravelly fine sandy loam to a depth of 28 inches; strong brown and pale brown gravelly fine sandy loam to a depth of 60 inches; and mottled, strong brown, pale brown, and red sandy clay loam to a depth of 72 inches or more.

This soil is low in natural fertility and content of organic matter. It is medium acid to very strongly acid throughout, except where the surface layer has been limed. Permeability is moderate, and the available water capacity is medium. The root zone is deep and easily penetrated.

Included with this soil in mapping are small areas where the soil is free of gravel, where the soil is stony, or where bedrock is at a depth of less than 60 inches. Also included are small areas of Estate and Portia soils.

The soil in this unit is not suited to cultivated crops. Runoff is rapid, and erosion is a very severe hazard if cultivated crops are grown. This soil is used mainly for upland hardwoods and pine or pasture. It is moderately suited to pasture. The pasture plants adapted to this soil include tall fescue, bahiagrass, white clover, lespedeza, and bermudagrass.

This soil is well suited to woodland use. The species adapted to this soil include shortleaf pine, loblolly pine, white oak, and red oak. There are no significant limitations to woodland use and management.

Slope is a moderate limitation for dwellings and local roads and streets. Slope is a severe limitation for small commercial buildings. In most places, this limitation can be overcome by good design and careful installation. Slope is a moderate limitation for septic tank absorption fields. In most places, this limitation can be overcome by careful installation.

The capability unit is 11e-1. The woodland suitability group is 3o7.

11—Captina silt loam, 1 to 3 percent slopes. This is a deep, moderately well drained, nearly level soil on broad uplands and stream terraces. Slopes are smooth and convex. Individual areas range from about 6 to 100 acres in size.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil in the upper part is yellowish brown silt loam to a depth of about 13 inches and strong brown silty clay loam to a depth of 24 inches. The middle part is a compact and brittle fragipan of mottled strong brown, gray, yellowish brown, and yellowish red silty clay loam to a depth of 44 inches. The lower part is red cherty clay to a depth of 72 inches or more.

This soil is low in natural fertility and in content of organic matter. It is strongly acid to slightly acid in the surface layer and extremely acid to strongly acid in the subsoil. Permeability is slow, and the available water capacity is medium. Tilth is good, and the soil can be worked throughout a wide range of moisture content. A water table is perched above the fragipan in late winter and early spring. The fragipan restricts root penetration and slows the movement of water through the soil.

Included with this soil in mapping are small areas of Nixa, Tonti, Ventris, and Noark soils. Also included are a few small areas where the soil is eroded and areas that have a surface layer of cherty silt loam.

The soil in this unit is well suited to corn, soybeans, small grains, sorghum, and truck crops (fig. 3). Runoff is slow, and erosion is a moderate hazard if cultivated crops are grown. With management that includes contour cultivation and terraces on long slopes, clean-tilled crops that leave large amounts of residue can be grown safely year after year. This soil is used mainly for pasture and hay. It is well suited to pasture. The pasture plants adapted to this soil include tall fescue, white clover, lespedeza, and bermudagrass.

This soil is moderately suited to woodland use. Shortleaf pine, red oak, and eastern redcedar are the only adapted species. There are no significant limitations to woodland use and management.

Wetness is a moderate limitation for dwellings and small commercial buildings. Low strength is a severe limitation for local roads and streets. In most places, these limitations can be overcome with proper engineering design and drainage. Slow permeability and wetness are severe limitations for septic tank absorption fields. These limitations can be partially overcome by

increasing the size of the absorption area or modifying the absorption field.

The capability unit is 11e-2. The woodland suitability group is 4o7.

12—Captina silt loam, 3 to 8 percent slopes. This is a deep, moderately well drained, gently sloping soil on uplands and stream terraces. Slopes are smooth and convex. Individual areas range from about 5 to 80 acres in size.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil in the upper part is yellowish brown silt loam to a depth of about 13 inches and strong brown silty clay loam to a depth of 24 inches. The middle part is a compact and brittle fragipan of mottled strong brown, gray, yellowish brown, and yellowish red silty clay loam to a depth of 44 inches. The lower part is red cherty clay to a depth of 72 inches or more.

This soil is low in natural fertility and in content of organic matter. It ranges from strongly acid to slightly



Figure 3.—Captina silt loam, 1 to 3 percent slopes, is well suited to sorghum.

acid in the surface layer and extremely acid to strongly acid in the subsoil. Permeability is slow, and the available water capacity is medium. Tillage is good, and the soil can be worked throughout a wide range of moisture conditions. A water table is perched above the fragipan in late winter and early spring. The fragipan restricts root penetration and slows the movement of water through the soil.

Included with this soil in mapping are small areas of Nixa, Tonti, Ventris, and Noark soils. Also included are a few small areas where the soil is eroded and areas that have a surface layer of cherty silt loam.

The soil in this unit is moderately suited to cultivated crops. Adapted crops include corn and small grains. Runoff is medium, but erosion is a severe hazard if cultivated crops are grown. With management that includes minimum tillage, contour cultivation, and terraces, crops that leave large amounts of residue can be safely grown year after year. Conservation treatment measures will need to be intensified as the length and grade of the slope increase. The soil is used mainly for pasture and hay. It is well suited to pasture (fig. 4). Adapted pasture plants include tall fescue, white clover, lespedeza, and bermudagrass.

This soil is moderately suited to woodland use. The adapted species include shortleaf pine, red oak, and eastern redcedar. There are no significant limitations to woodland use and management.

Low strength is a severe limitation for local roads and streets. Wetness and slope are moderate limitations for small commercial buildings. Wetness is a moderate limitation for dwellings. In most places, these limitations can be overcome by proper engineering design and drainage. Slow permeability and wetness are severe limitations for septic tank absorption fields. These limitations can be partially overcome by increasing the size of the absorption area or by modifying the absorption field.

The capability unit is 111e-3. The woodland suitability group is 4o7.

13—Clarksville very cherty silt loam, 20 to 50 percent slopes. This is a deep, somewhat excessively drained, steep, very cherty soil on hillsides. Slopes are smooth and complex. Individual areas range from about 20 to 500 acres in size.



Figure 4.—Captina silt loam, 3 to 8 percent slopes, is well suited to pasture.

Typically, the surface layer is dark grayish brown very cherty silt loam about 3 inches thick. The subsurface layer is pale brown very cherty silt loam to a depth of about 12 inches. The subsoil is strong brown very cherty silt loam to a depth of about 20 inches, yellowish red very cherty silty clay loam to a depth of 32 inches, and red very cherty silty clay to a depth of 72 or more inches.

This soil is low in natural fertility and in content of organic matter. It is strongly acid or very strongly acid throughout. Permeability is moderately rapid. Because the content of chert is high, the available water capacity is low, and consequently the soil is droughty. Chert fragments on the surface and the slope limit the use of farm equipment. The root zone is deep.

Included with this soil in mapping are small areas of Arkana, Estate, Moko, Noark, and Elsay soils. Also included are small areas of very narrow, cobbly flood plains, small areas of Rock outcrop, small spots where cherty limestone bedrock is within 3 feet of the surface, and areas where the slope is greater than 50 percent.

The soil in this unit is not suited to cultivated crops or improved pasture. Runoff is rapid, and erosion is a very severe hazard. Tame pasture plants are difficult to establish and maintain. The soil is better suited to use as woodland, range, and wildlife habitat.

This soil is used mainly for upland hardwoods and pines. It is moderately suited to use as woodland. The adapted species include shortleaf pine, white oak, and loblolly pine. Erosion is a moderate hazard, and seedling mortality and equipment limitations are severe.

This soil has severe limitations for most urban uses. The steep slopes are a severe limitation for dwellings, roads and streets, small commercial buildings, and septic tank absorption fields. This limitation is difficult or impractical to overcome.

The capability unit is VIIIs-2. The woodland suitability group is 4f9.

14—Doniphan very cherty silt loam, 3 to 8 percent slopes. This is a deep, well drained, gently sloping soil on uplands. Slopes are smooth and convex. Individual areas range from about 10 to 60 acres in size.

Typically, the surface layer is dark brown very cherty silt loam about 1 inch thick. The subsurface layer is light yellowish brown very cherty silt loam to a depth of about 9 inches. The subsoil is strong brown very cherty silt loam to a depth of about 17 inches; yellowish red, mottled cherty silty clay to a depth of about 29 inches; dark red, mottled clay to a depth of about 56 inches; and mottled, dark red, strong brown, and light gray clay to a depth of 72 inches or more.

This soil is low in natural fertility and in content of organic matter. It is slightly acid to strongly acid in the surface layer and strongly acid or very strongly acid in the subsoil. Permeability is moderate, and the available water capacity is medium. Tillage is difficult to maintain, and the very cherty surface limits the use of some tillage

implements. The root zone is deep, but the clayey subsoil restricts root penetration.

Included with this soil in mapping are a few small areas of Arkana, Nixa, and Ventris soils.

The soil in this unit is moderately suited to cultivated crops. Runoff is medium to rapid, and erosion is a severe hazard. The crops adapted to this soil include small grains. If management includes minimum tillage, terraces, and contour cultivation, crops that leave large amounts of residue can be grown safely year after year. Conservation treatment needs to be intensified as the length and grade of the slope increase.

This soil is well suited to pasture. Bermudagrass, tall fescue, white clover, and annual lespedeza are the pasture plants adapted to this soil.

This soil is used mainly for low grade hardwoods or pasture. It is moderately suited to use as woodland. The species adapted to this soil include shortleaf pine and white oak. There are no significant limitations to woodland use and management.

The shrink-swell potential is a moderate limitation for dwellings. Low strength of the soil is a severe limitation for roads and streets. The shrink-swell potential and slope are moderate limitations for small commercial buildings. In most places, these limitations can be overcome by proper engineering design. Moderate permeability is a moderate limitation for septic tank absorption fields. This limitation, in most places, can be overcome by increasing the size of the field or modifying the field itself.

The capability unit is IIIs-4. The woodland suitability group is 3o7.

15—Doniphan very cherty silt loam, 8 to 20 percent slopes. This is a deep, well drained, moderately sloping to moderately steep soil on side slopes. Slopes are smooth and convex. Individual areas range from about 20 to 200 acres in size.

Typically, the surface layer is dark brown very cherty silt loam about 1 inch thick. The subsurface layer is light yellowish brown very cherty silt loam to a depth of about 9 inches. The subsoil is strong brown very cherty silt loam to a depth of about 17 inches; yellowish red, mottled cherty silty clay to a depth of 29 inches; dark red, mottled clay to a depth of about 56 inches; and mottled, dark red, strong brown, and light gray clay to a depth of 72 inches or more.

This soil is low in natural fertility and moderate in content of organic matter. It ranges from slightly acid to strongly acid in the surface layer and is strongly acid or very strongly acid in the subsoil. Permeability is moderate, and the available water capacity is medium. Tillage is difficult to maintain. Slope and the very cherty surface layer limit the use of farm equipment. The root zone is deep, but the clayey subsoil restricts root penetration.

Included with this soil in mapping are a few small areas of Arkana, Gassville, Nixa, and Ventris soils.

The soil in this unit is used mainly for mixed low grade hardwoods or pasture. It is not suited to cultivated crops. Runoff is rapid, and the erosion hazard is very severe. The soil is poorly suited to pasture (fig. 5). The pasture plants adapted to this soil include bermudagrass, tall fescue, white clover, and annual lespedeza.

This soil is well suited to woodland use. The species adapted to this soil include shortleaf pine and white oak. The erosion hazard and seedling mortality are moderate limitations to woodland use or management.

The shrinking and swelling and slope are moderate limitations for dwellings. Slope is a severe limitation for small commercial buildings. Low strength of the soil is a severe limitation for roads and streets. In most places, the limitations can be overcome by proper engineering design. Moderate permeability and slope are moderate limitations for septic tank absorption fields. These limitations may be partly overcome by increasing the size of the absorption field or by modifying the field itself.

The capability unit is Vle-3. The woodland suitability group is 3r8.

16—Elsah cherty loam, frequently flooded. This is a deep, somewhat excessively drained, level or nearly level soil on narrow flood plains. Individual areas range from about 10 to 50 acres in size.

Typically, the surface layer is very dark grayish brown cherty loam about 9 inches thick. The underlying material is dark brown very cherty loam to a depth of about 34 inches, dark yellowish brown very cherty silt loam to a depth of about 42 inches, and dark brown and brown very cherty loam to a depth of about 72 inches. Below the underlying material there is hard, level-bedded limestone bedrock.

This soil is moderate in natural fertility and organic matter content. Reaction ranges from neutral to medium acid throughout. Permeability is moderately rapid, and available water capacity is low. Tilth is good, and the soil can be worked throughout a wide range of moisture content. Chert fragments in the surface layer hinder tillage operations. The root zone is deep and easily penetrated. In most years, this soil is frequently flooded



Figure 5.—Farm ponds provide water for livestock, fish production, recreation, and wildlife habitat. The soil is Doniphan very cherty silt loam, 8 to 20 percent slopes.



Figure 6.—An area of Estate-Portia-Moko association, rolling. Estate soils are on the upper side slopes, Moko soils are near the limestone outcrop, and Portia soils are on the lower side slopes.

in most areas from December to May. Fast-moving water floods it for very brief periods, causing severe damage.

Included with this soil in mapping are small areas of Razort soils, areas of gravel bars, narrow overflow channels, and areas where the surface is free of chert.

The soil in this unit is not suited to cultivated crops. The hazard of flooding, the chert at the surface, and the low available water capacity are limitations. The soil is used mainly as woodland or as improved pasture. It is well suited to pasture. The pasture plants adapted to this soil include bermudagrass, tall fescue, alfalfa, white clover, and lespedeza.

This soil is well suited to woodland use. The species adapted to this soil include sweetgum, cottonwood, black walnut, and sycamore. Seedling mortality is a moderate limitation to woodland use and management.

This soil has severe limitations for most urban uses. Flooding is a severe hazard for dwellings, small commercial buildings, local roads and streets, and septic tank absorption fields. Major flood control practices are needed to overcome this limitation.

The capability unit is Vw-1. The woodland suitability group is 3f5.

17—Estate-Portia-Moko association, rolling. This association consists of deep and shallow, well drained soils on rolling uplands and side slopes. The individual soils are in areas large enough to be mapped separately, but they were not separated because access is difficult and the intensity of use is low. The soils generally are in a regular, repeating pattern, and the proportion of each is about the same in every mapped area. The mapped areas range from about 40 to 250 acres in size. The slope ranges from 8 to 20 percent.

Estate soils make up about 35 percent of this association, Portia soils make up 30 percent, and Moko soils make up 25 percent. Clarksville, Nixa, and Noark soils and a few small areas of Rock outcrop (fig. 6) make up the rest.

Estate and Portia soils are deep and well drained. They formed in residuum of weathered interbedded sandstone and limestone. Estate soils are on upper side slopes, and Portia soils are on the less sloping foot slopes. Moko soils are shallow and well drained. They formed in residuum of weathered limestone. They are on side slopes near limestone outcrops.

Typically, Estate soils have a surface layer that is dark grayish brown stony sandy loam about 3 inches thick. The subsurface layer is yellowish brown stony sandy loam to a depth of about 8 inches. The subsoil is yellowish red sandy loam to a depth of 12 inches, yellowish red clay loam to a depth of 20 inches, red clay to a depth of 36 inches, and red, mottled clay to a depth of 48 inches. The bedrock, below the subsoil, is hard, undulating limestone.

The permeability is slow, and the available water capacity is medium. Natural fertility and the organic matter content are low. Reaction ranges from strongly acid to neutral in the subsoil. The root zone is deep and easily penetrated by roots.

Typically, Portia soils have a surface layer that is brown fine sandy loam about 4 inches thick. The subsoil is dark brown fine sandy loam to a depth of about 10 inches, reddish brown sandy clay loam to a depth of 20 inches, and red sandy clay loam to a depth of 72 inches or more.

Permeability is moderate, and the available water capacity is medium. Natural fertility and the organic matter content are low. Reaction ranges from slightly acid to strongly acid in the surface layer and upper part of the subsoil and from medium acid to very strongly acid in the lower part. Tilth is good. The soil can be worked throughout a wide range of moisture content. The root zone is deep and easily penetrated by roots.

In a typical area of Moko soils, very dark brown and very dark grayish brown very stony silt loam about 10 inches thick overlies hard limestone bedrock.

Permeability is moderate, and the available water capacity is very low. Natural fertility and the organic matter content are moderate. Reaction is neutral or mildly alkaline throughout.

Estate and Moko soils are not suited to cultivated crops. Slopes, runoff, surface stones, and depth to bedrock are severe limitations for this use. Portia soils are poorly suited to cultivated crops. Slope, runoff, and a severe erosion hazard are limitations. Adapted crops include small grains. With management that includes minimum tillage, contour cultivation, and terracing, sown crops can be grown occasionally in a cropping system that includes a close-growing cover crop most of the time. Conservation treatment needs to be intensified as the length and grade of the slope increase.

Portia soils, in most areas, have been cleared and are used for improved pasture. They are well suited to improved pasture. Moko soils are not suited to improved pasture, and Estate soils are poorly suited (fig. 7). The pasture plants adapted to the Estate soils include bermudagrass, bahiagrass, lespedeza, tall fescue, and white clover.

Estate and Moko soils are used mainly as woodland. Estate soils are moderately suited to woodland use. The species adapted to Estate soils include red oak, white oak, shortleaf pine, loblolly pine, and redcedar. The erosion hazard is moderate and equipment limitations are moderate for woodland use and management. Portia

soils are well suited to woodland use. The species adapted to Portia soils include shortleaf pine, loblolly pine, and sweetgum. The hazard of erosion is a moderate limitation to woodland use and management. Moko soils are poorly suited to woodland use. The best adapted species is redcedar. Equipment limitations, seedling mortality, and the hazard of erosion are severe limitations to woodland use and management.

Estate soils have moderate limitations for dwellings because of the shrink-swell potential and the slope. Slope is a severe limitation for small commercial buildings. Low strength and slope are severe limitations for roads and streets. Slow permeability is a severe limitation for septic tank absorption fields. Portia soils have moderate limitations for dwellings because of the slope. Slope is a severe limitation for small commercial buildings. Low strength and slope are moderate limitations for roads and streets. Moderate permeability and slope are moderate limitations for septic tank absorption fields. These limitations may be partly overcome by good engineering design and careful installation. Moko soils have severe limitations to use as sites for dwellings, small commercial buildings, roads, streets, and septic tank absorption fields because of depth to bedrock and large stones on the surface. These limitations are difficult or impractical to overcome.

Estate soils are in capability unit VIs-3 and woodland suitability group 4x8. Portia soils are in capability unit IVe-2 and in woodland suitability group 3r8. Moko soils are in capability unit VIIs-4 and in woodland suitability group 5x3.

18—Estate-Portia-Moko association, steep. This association consists of deep and shallow, well drained soils on steep side slopes. The individual soils are in areas large enough to be mapped separately, but they were not separated because access is difficult and the intensity of use is low. The soils generally are in a regular, repeating pattern, and the proportion of each is about the same in every mapped area. The mapped areas range from about 40 to 750 acres in size. The slope ranges from 20 to 40 percent for the Estate and Moko soils and 20 to 30 percent for Portia soils.

Estate soils make up about 35 percent of this association, Portia soils make up 30 percent, and Moko soils make up 25 percent. Clarksville, Nixa, and Noark soils, small areas of limestone outcrops, and areas of massive, vertical escarpments of interbedded sandstone and limestone make up the rest.

Estate and Portia soils are deep and well drained. They formed in residuum of weathered interbedded sandstone and limestone. Estate soils are on upper side slopes, and Portia soils are on the less sloping foot slopes. Moko soils are shallow and well drained. They formed in residuum of weathered limestone. They are on side slopes near limestone outcrops.

Typically, Estate soils have a surface layer that is dark grayish brown stony sandy loam about 3 inches thick.



Figure 7.—Bahiagrass on Estate stony sandy loam in an area of Estate-Portia-Moko association, rolling. Stones on the surface limit the use of some farm equipment and make weed and brush control difficult.

The subsurface layer is yellowish brown stony sandy loam to a depth of about 8 inches. The subsoil is yellowish red sandy loam to a depth of 13 inches, yellowish red clay loam to a depth of 20 inches, red clay to a depth of 36 inches, and red, mottled clay to a depth of 48 inches. The bedrock, below the subsoil, is hard, undulating limestone.

Permeability is slow, and the available water capacity is medium. Natural fertility and the organic matter content are low. Reaction ranges from strongly acid to neutral in the surface layer and is medium acid to neutral in the subsoil. The root zone is deep and easily penetrated by roots.

Typically, Portia soils have a surface layer that is brown fine sandy loam about 4 inches thick. The subsoil is dark brown fine sandy loam to a depth of about 10 inches, reddish brown sandy clay loam to a depth of 20

inches, and red sandy clay loam to a depth of 72 inches or more.

Permeability is moderate, and the available water capacity is medium. Natural fertility and the organic matter content are low. Reaction ranges from slightly acid to strongly acid in the surface layer and upper part of the subsoil and from medium acid to very strongly acid in the lower part. The root zone is deep and easily penetrated by roots.

In a typical area of Moko soils, very dark brown and very dark grayish brown very stony silt loam about 9 inches thick overlies hard limestone bedrock.

Permeability is moderate, and the available water capacity is very low. Natural fertility and the organic matter content are moderate. Reaction is neutral or mildly alkaline throughout.

The soils of this association are not suited to cultivated crops or improved pasture. Because of steep slopes, surface stones, and escarpments, these soils are suited to use as woodland, range, and wildlife habitat and for recreation. They are used mainly as woodland or range.

Estate soils are moderately suited to woodland use. The adapted species are red oak, white oak, shortleaf pine, loblolly pine, and redcedar. Erosion is a severe hazard and the equipment limitations are severe for woodland use and management. Portia soils are well suited to woodland use. The adapted species are shortleaf pine, loblolly pine, and sweetgum. The hazard of erosion and equipment limitations are moderate. Moko soils are poorly suited to woodland use. The best adapted species is redcedar. The hazard of erosion, seedling mortality, and equipment limitations are severe.

This association has severe limitations for most urban uses. Estate soils have severe limitations for dwellings and small commercial buildings because of the steep slope. Low soil strength and slope are severe limitations for roads and streets. Depth to rock, slow permeability, and slope are severe limitations for septic tank absorption fields. Portia soils have severe limitations for dwellings, small commercial buildings, roads and streets, and septic tank absorption fields because of slope. Moko soils have severe limitations for dwellings, small commercial buildings, roads and streets, and septic tank absorption fields because of shallowness to bedrock, large stones on the surface, and slope. These limitations are difficult or impractical to overcome.

Estate soils are in capability unit VIIIs-1 and in woodland suitability group 4x9. Portia soils are in capability unit VIe-2 and in woodland suitability group 3r8. Moko soils are in capability unit VIIIs-4 and in woodland suitability group 5x3.

19—Gassville very cherty silt loam, 20 to 40 percent slopes. This is a moderately deep, well drained, steep soil on side slopes. Slopes are uneven and convex. Individual areas range from about 15 to 75 acres in size.

Typically, the surface layer is dark brown very cherty silt loam to a depth of about 1 inch. The subsurface layer is brown very cherty silt loam to a depth of about 6 inches. The subsoil is strong brown very cherty silt loam to a depth of about 10 inches, yellowish red cherty clay to a depth of 19 inches, yellowish red, mottled clay to a depth of 28 inches, and mottled, red and yellowish brown clay to a depth of 38 inches. The underlying material is rippable siltstone bedrock to a depth of about 55 inches. Below that, there is hard dolomite bedrock.

This soil is low in natural fertility and in content of organic matter. It ranges from strongly acid to slightly acid in the surface layer and is very strongly acid or strongly acid in the subsoil. Permeability is very slow, and the available water capacity is low. Surface chert

and slope limit the use of farm equipment. The root zone is moderately deep, but the clayey subsoil restricts root penetration.

Included with this soil in mapping are small areas of Arkana, Doniphan, and Moko soils, Elsay and Razort soils on narrow flood plains, and a few areas of Rock outcrop.

The soil in this unit is not suited to cultivated crops. Runoff is rapid, and the hazard of erosion is very severe. The soil is suited to use as rangeland, woodland, and wildlife habitat. It is used mainly for low grade upland hardwoods and cedar. It is poorly suited to pasture. Tame pasture plants are difficult to establish and maintain. Adapted pasture plants include tall fescue and white clover.

This soil is moderately suited to woodland use. Adapted species include shortleaf pine, eastern redcedar, and red oak. Erosion and seedling mortality are moderate hazards. The equipment limitation is severe.

This soil has severe limitations for most urban uses. Low strength and slope are severe limitations for roads and streets. Slope is a severe limitation for dwellings and small commercial buildings. These limitations can be partly overcome with proper engineering design and careful installation. Very slow permeability and slope are severe limitations for septic tank absorption fields. These limitations are difficult or impractical to overcome.

The capability unit is VIIIs-3. The woodland suitability group is 4r9.

20—Healing silt loam, 1 to 3 percent slopes. This is a deep, well drained, nearly level soil on low terraces along the White and Norfolk Rivers. Slopes are smooth and convex, but some mapped areas are on two or more levels, for example, a series of terraces. The mapped areas are long and narrow, generally less than one-fourth mile wide, paralleling the rivers. The areas range from about 40 to 200 acres in size.

Typically, the surface layer is dark brown silt loam about 13 inches thick. The subsoil is brown silt loam to a depth of about 26 inches, reddish brown silt loam to a depth of 68 inches, and brown silt loam to a depth of 80 inches or more.

This soil is moderate to high in natural fertility and in content of organic matter. It is medium acid or slightly acid throughout. Permeability is moderate, and the available water capacity is high. The soil has good tilth and can be worked throughout a wide range of moisture conditions. The root zone is deep and easily penetrated by roots.

Included with this soil in mapping are small areas of Wideman and Britwater soils that have a surface layer of loam or fine sandy loam, soils that have a surface layer that is thick and dark colored, and small areas bisected by streams where slopes are steeper than 3 percent.

This soil is well suited to cultivated crops. Adapted crops include corn, soybeans, small grains, and truck

crops. Erosion is a moderate hazard if cultivated crops are grown. If the soil is well managed, clean-tilled crops that leave large amounts of residue can be grown safely year after year. Conservation treatment needs to be intensified as the length and grade of the slope increase. The soil is used mainly for hay or pasture. It is well suited to pasture. Adapted pasture plants include alfalfa, tall fescue, white clover, orchardgrass, bermudagrass, and lespedeza.

The soil is well suited to woodland use. The species adapted to this soil include black walnut, eastern cottonwood, and other bottomland hardwoods. There are no significant limitations to woodland use and management.

There are no significant limitations for dwellings, small commercial buildings, and septic tank absorption fields. Low strength is a severe limitation for local roads and streets. The soil is protected from flooding by flood retarding structures upstream.

The capability unit is 11e-3. The woodland suitability group is 2o7.

21—Moko-Rock outcrop complex, 3 to 15 percent slopes. This complex consists of Moko very stony silt loam and Rock outcrop. The areas of this complex are on uplands. They are so intermingled that they could not be separated at the scale selected for mapping. The areas range from about 10 to 50 acres in size. The individual areas of the Moko soil and of Rock outcrop range from about 1 acre to 4 acres.

Moko very stony silt loam makes up about 65 percent of each mapped area. In a typical area of this soil, very dark brown and very dark grayish brown very stony silt loam, about 12 inches thick, overlies bedrock of hard dolomite.

The Moko soil is moderate in natural fertility and in content of organic matter. Reaction is neutral or mildly alkaline throughout. Permeability is moderate, and the available water capacity is very low.

Rock outcrop makes up about 25 percent of each mapped area. The rock is hard, level-bedded dolomite or limestone.

The remaining 10 percent of this complex consists of small areas of Arkana and Ventriss soils, quarries, and small areas where the slopes are greater than 15 percent.

The soils in this complex are not suited to cultivated crops or improved pasture. They are better suited to wildlife habitat, range, cedar post production, and recreation. These soils should not be cleared. Erosion is a very severe hazard if the native vegetation is disturbed. The soils are used mainly for range. There are scattered redcedars with an understory of prairie plants (fig. 8).

The Moko soil is poorly suited to use as woodland. Eastern redcedar is the main adapted species. The equipment limitation is severe, and the erosion hazard and seedling mortality are moderate.

The limitations for most urban uses are severe. Depth to bedrock, large stones, and rock outcrops severely

limit the use of the soils for dwellings, small commercial buildings, roads and streets, and septic tank absorption fields. The limitations are difficult or impractical to overcome.

The Moko soil is in capability unit VIIs-4 and in woodland suitability group 5x3.

22—Moko-Rock outcrop complex, 15 to 40 percent slopes. This complex consists of Moko very stony silt loam and Rock outcrop. The areas of this complex are on steep hillsides. They are so intermingled that they could not be separated at the scale selected for mapping. The areas range from about 10 to 100 acres in size. Individual areas of the Moko soil and of Rock outcrop range from 1 to 4 acres in size.

Moko very stony silt loam makes up about 70 percent of each mapped area. In a typical area of this soil, very dark brown and very dark grayish brown very stony silt loam about 6 inches thick overlies hard dolomite bedrock.

The Moko soil is moderate in natural fertility and in content of organic matter. Reaction is neutral or mildly alkaline throughout. Permeability is moderate, and the available water capacity is very low.

Rock outcrop makes up about 20 percent of each mapped area. Typically, it is hard, level-bedded dolomite or limestone.

The remaining 10 percent of this complex consists of small areas of Arkana soils, quarries, areas where the slope is greater than 40 percent, and areas of vertical bluffs and escarpments of dolomite, limestone, and sandstone.

The soils in this complex are not suited to cultivated crops or improved pasture. They are better suited to wildlife habitat, rangeland, and recreation use. These soils should not be cleared. Erosion is a very severe hazard if the native vegetation is disturbed. The soils are used mainly for range. There are scattered redcedars and an understory of prairie plants.

The Moko soil is poorly suited to woodland use. The main adapted species is eastern redcedar. Equipment limitations, erosion hazard, and seedling mortality are severe.

The limitations for most urban uses are severe. Depth to bedrock, large stones, slope, and rock outcrops severely limit the use of the soils for dwellings, industrial sites, roads, streets, and septic tank absorption fields. These limitations are difficult or impractical to overcome.

Moko soil is in capability unit VIIs-4 and in woodland suitability group 5x3.

23—Mountainburg gravelly loam, 3 to 8 percent slopes. This is a shallow, well drained, gently sloping soil on broad mountaintops. Slopes are smooth and convex. Individual areas are 20 to 200 acres in size.

Typically, the surface layer is very dark grayish brown gravelly loam about 1 inch thick. The subsurface layer is



Figure 8.—Eastern redcedar and little bluestem on Moko-Rock outcrop complex, 3 to 15 percent slopes. These soils are used mainly for range.

brown gravelly loam to a depth of about 9 inches. The subsoil is strong brown, very gravelly sandy clay loam to a depth of about 18 inches. Below the subsoil there is hard, level-bedded, acid sandstone.

This soil is low in natural fertility and organic matter. It is medium acid or strongly acid in the surface layer and strongly acid or very strongly acid in the subsoil. Permeability is moderately rapid, and the available water capacity is very low. The root depth is shallow but is easily penetrated by roots.

Included with this soil in mapping are small areas of Sidon soils and areas of soils that have a sandy loam or gravelly sandy loam surface layer or that are stony.

The soil in this unit is mainly used for pasture or hay or woodland. It is poorly suited to cultivated crops. A shallow root zone, high content of gravel, very low available water capacity, and stony spots severely limit the use of this soil for cultivated crops. This soil is poorly suited to pasture. The pasture plants adapted to this soil include bermudagrass, bahiagrass, and lespedeza. This

soil is poorly suited to woodland use. The species adapted to this soil include shortleaf pine, loblolly pine, and redcedar. Seedling mortality is moderate.

This soil has severe limitations for most urban uses. Depth to bedrock severely limits the use of this soil for dwellings, small commercial buildings, local roads and streets, and septic tank absorption fields. This limitation is difficult or impractical to overcome.

The capability unit is IVe-3. The woodland suitability group is 5d2.

24—Mountainburg very stony sandy loam, 3 to 15 percent slopes. This is a shallow, well drained, gently sloping to moderately sloping stony soil on broad mountaintops. Slopes are smooth and convex. Individual areas range from about 15 to 100 acres in size.

Typically, the surface layer is dark grayish brown very stony sandy loam about 1 inch thick. The subsurface layer is brown very stony sandy loam to a depth of about 6 inches. The subsoil is strong brown very gravelly sandy

clay loam to a depth of about 18 inches. Below the subsoil there is hard, level-bedded acid sandstone bedrock.

This soil is low in natural fertility and in content of organic matter. It is strongly acid or medium acid in the surface layer and very strongly acid or strongly acid in the subsoil. Permeability is moderately rapid and the available water capacity is very low because of shallowness to bedrock and high content of stone. The root zone is shallow but is easily penetrated by roots.

Included with this soil in mapping are small areas of Sidon soils, areas of soils that have a surface layer of sandy loam or gravelly sandy loam, and occasional outcrops of sandstone.

The soil in this unit is used mainly as woodland, rangeland, and native pasture. It is not suited to cultivated crops. Stones on the surface limit the use of farm equipment, and the soil is droughty. Erosion is a severe hazard if the native vegetation is disturbed. This soil is poorly suited to pasture. The pasture plants adapted to this soil include bermudagrass, bahiagrass, and lespedeza. The soil is poorly suited to woodland use. The species adapted to this soil include shortleaf pine, loblolly pine, and redcedar. Equipment limitations are severe, and seedling mortality is moderate.

This soil has severe limitations to most urban uses. Depth to bedrock and surface stones are severe limitations for dwellings, small commercial buildings, local roads and streets, and septic tank absorption fields. These limitations are very difficult or impractical to overcome.

The capability unit is VIs-4. The woodland suitability group is 5x3.

25—Mountainburg very stony sandy loam, 15 to 40 percent slopes. This is a shallow, well drained very stony soil on steep side slopes. Slopes are broken and irregular. Individual areas range from about 25 to 75 acres in size.

Typically, the surface layer is dark grayish brown very stony sandy loam about 1 inch thick. The subsurface layer is brown, very stony sandy loam to a depth of about 6 inches. The subsoil is strong brown very gravelly sandy clay loam to a depth of about 18 inches. Below the subsoil there is hard, level-bedded acid sandstone.

This soil is low in natural fertility and in content of organic matter. It is strongly acid or medium acid in the surface layer and very strongly acid or strongly acid in the subsoil. Permeability is moderately rapid, and the available water capacity is very low because of shallowness to bedrock and large stones. The root zone is shallow but is easily penetrated by roots.

Included with this soil in mapping are areas of soils that have a surface layer of gravelly sandy loam, areas of sandstone outcrops and escarpments, and small areas where the slope is more than 40 percent.

The soil in this unit is not suited to cultivated crops or improved pasture. Stones on the surface, rock ledges,

and steep slopes severely restrict the use of farm equipment. Furthermore, the soil is droughty. Erosion is a very severe hazard if the native vegetation is disturbed. The soil is best suited to native pasture, wildlife habitat, or recreation uses.

Although it is poorly suited to woodland use, this soil is used mainly as woodland. The species adapted to this soil include shortleaf pine, loblolly pine, and redcedar. Equipment limitations are severe, erosion is a severe hazard, and seedling mortality is moderate.

The limitations for most urban uses are severe. Depth to bedrock, large stones, and steep slopes severely limit the use of the soils for dwellings, small commercial buildings, local roads and streets, and septic tank absorption fields. These limitations are very difficult or impractical to overcome.

The capability unit is Vlls-5. The woodland suitability group is 5x3.

26—Nixa very cherty silt loam, 3 to 8 percent slopes. This is a deep, moderately well drained, gently sloping soil on narrow ridgetops and uplands. Individual areas range from about 10 to 200 acres in size.

Typically, the surface layer is very dark grayish brown very cherty silt loam about 2 inches thick. The subsurface layer is brown very cherty silt loam to a depth of about 11 inches. The subsoil in the upper part is light yellowish brown very cherty silt loam to a depth of about 22 inches. The middle part is a fragipan of mottled very cherty silt loam to a depth of about 44 inches. The lower part is a mottled yellowish red, strong brown, and light brownish gray very cherty silty clay loam to a depth of 72 inches or more.

This soil is low in natural fertility and in content of organic matter. Reaction is strongly acid or very strongly acid throughout. The permeability is very slow, and the available water capacity is low. Tillage is difficult to maintain, and the high content of chert fragments makes the soil droughty and tillage operations difficult. The fragipan restricts root penetration and slows the movement of water through the soil.

Included with this soil in mapping are small areas of Captina, Tonti, Noark, and Doniphan soils. Also included are areas where the surface layer contains less than 35 percent chert and small areas where the slope is less than 3 percent or more than 8 percent.

This soil is moderately suited to cultivated crops. Adapted crops include small grains. Runoff is moderate to rapid, and the hazard of erosion is severe. With management that includes minimum tillage, contour cultivation, and terracing, crops that leave large amounts of residue can be grown year after year. Conservation treatment will need to be intensified as the length and grade of the slope increase. The soil is used mainly as woodland or pasture. It is moderately suited to pasture. The pasture plants adapted to this soil include tall fescue, white clover, and bermudagrass.

This soil is moderately suited to woodland use. The species adapted to this soil include shortleaf pine,

loblolly pine, eastern redcedar, and red oak. The erosion hazard and equipment limitations are slight, and seedling mortality is moderate.

There are no significant limitations for dwellings or local roads and streets. Slope is a moderate limitation for small commercial buildings. Very slow permeability is a severe limitation for septic tank absorption fields. This limitation can be partially overcome by increasing the size of the absorption area or by modifying the absorption field.

The capability unit is IIIs-1. The woodland suitability group is 4f8.

27—Nixa very cherty silt loam, 8 to 12 percent slopes. This is a deep, moderately well drained, moderately sloping soil on long narrow ridgetops and uplands. Individual areas range from about 10 to 80 acres in size.

Typically, the surface layer is very dark grayish brown very cherty silt loam about 2 inches thick. The subsurface layer is brown very cherty silt loam to a depth of about 11 inches. The subsoil in the upper part is light yellowish brown very cherty silt loam to a depth of about 22 inches. The middle part is a fragipan of yellowish brown, mottled very cherty silt loam to a depth of about 44 inches. The lower part is mottled yellowish red, strong brown, and light brownish gray very cherty silty clay loam to a depth of 72 inches or more.

This soil is low in natural fertility and in content of organic matter. It is strongly acid or very strongly acid throughout. The permeability is very slow, and the available water capacity is low. Tilth is difficult to maintain, and the high content of chert fragments makes the soil droughty and tillage operations difficult. The fragipan restricts root penetration and slows the movement of water through the soil.

Included with this soil in mapping are small areas where the slope is less than 8 percent or more than 12 percent. Also included are small areas of Clarksville, Noark, Doniphan, and Gassville soils.

The soil in this unit is poorly suited to cultivated crops. Adapted crops include small grains. Runoff is rapid, and erosion is a very severe hazard. With management that includes minimum tillage, contour cultivation, and terracing, sown crops that leave large amounts of residue on the surface may be grown occasionally in a cropping system that includes close-growing cover most of the time. Conservation treatment will need to be intensified as the length and grade of the slope increase. This soil is used mainly as woodland or pasture. It is moderately suited to pasture. The pasture plants adapted to this soil include tall fescue, white clover, lespedeza, and bermudagrass.

This soil is moderately suited to woodland use. Adapted species include shortleaf pine, loblolly pine, eastern redcedar, and red oak. The erosion hazard and equipment limitations are slight, and seedling mortality is moderate.

Slope is a moderate limitation for dwellings and local roads and streets and severe for small commercial buildings. These limitations can be overcome by proper engineering design and careful installation. Very slow permeability is a severe limitation for septic tank absorption fields. These limitations may be partially overcome by increasing the size of the absorption area or by modifying the absorption field.

The capability unit is IVs-1. The woodland suitability group is 4f8.

28—Nixa-Doniphan complex, 3 to 8 percent slopes.

This complex consists of Nixa and Doniphan soils on uplands and low ridges. The slopes are smooth and convex. The areas of this complex range from about 10 to 60 acres in size. The areas of the individual soils range from about 3 to 5 acres in size. They are so intermingled that they could not be separated at the scale selected for mapping.

Nixa soils make up about 45 percent of each mapped area. Typically, the surface layer is very dark grayish brown very cherty silt loam about 2 inches thick. The subsurface layer is brown very cherty silt loam to a depth of about 11 inches. The subsoil in the upper part is light yellowish brown very cherty silt loam to a depth of about 22 inches. The middle part is a fragipan of yellowish brown, mottled very cherty silt loam to a depth of about 44 inches. The lower part is mottled yellowish red, strong brown, and light brownish gray very cherty silty clay loam to a depth of 72 inches or more.

Nixa soils are low in natural fertility and in content of organic matter. They are strongly acid or very strongly acid throughout. Permeability is very slow, and the available water capacity is low. Tilth is difficult to maintain, and the high content of chert fragments makes the soil droughty and tillage operations difficult. The fragipan restricts root penetration and slows the movement of water through the soil.

Doniphan soils make up about 40 percent of each mapped area. Typically, the surface layer is dark brown very cherty silt loam about 1 inch thick. The subsurface layer is light yellowish brown very cherty silt loam to a depth of about 9 inches. The subsoil is strong brown very cherty silt loam to a depth of about 17 inches; yellowish red, mottled cherty silty clay to a depth of about 29 inches; dark red, mottled clay to a depth of about 56 inches; and mottled, dark red, strong brown, and light gray clay to a depth of 78 inches or more.

Doniphan soils are low in natural fertility and in content of organic matter. They range from slightly acid to strongly acid in the surface layer and are strongly acid or very strongly acid in the subsoil. Permeability is moderate, and the available water capacity is medium. Tilth is difficult to maintain, and the very cherty surface limits the use of some tillage implements. The root zone is deep, but the clayey subsoil restricts root penetration.

The remaining 15 percent of this complex consists of small areas of Tonti, Captina, and Arkana soils.

These soils are moderately suited to cultivated crops. Runoff is medium to rapid, and erosion is a severe hazard if cultivated crops are grown. The crops adapted to these soils include small grains. With management that includes minimum tillage, terraces, and contour cultivation, crops that leave large amounts of residue can be safely grown year after year. Conservation treatment will need to be intensified as the length and grade of the slope increase. These soils are used mainly as woodland or pasture. They are moderately suited to pasture. The pasture plants adapted to these soils include tall fescue, white clover, bermudagrass, and lespedeza.

These soils are moderately suited to woodland use. The species adapted to these soils include shortleaf pine, loblolly pine, redcedar, and red oak. There are no significant limitations to woodland use or management for Doniphan soils. Seedling mortality is a moderate limitation for Nixa soils.

Nixa soils have no significant limitations for dwellings and local roads and streets. Slope is a moderate limitation for small commercial buildings. Very slow permeability is a severe limitation for septic tank absorption fields. Doniphan soils are moderately limited for dwellings because of shrinking and swelling. Low strength is a severe limitation for roads and streets. Slope and shrinking and swelling are moderate limitations for small commercial buildings. Moderate permeability is a moderate limitation for septic tank absorption fields. Most of these limitations can usually be overcome by proper engineering design and proper installation.

The capability unit is IIIs-1. The woodland suitability group for Nixa soils is 4f8 and for Doniphan soils is 3o7.

29—Nixa-Doniphan complex, 8 to 20 percent slopes. This complex consists of Nixa and Doniphan soils on rolling uplands and low ridges. The areas of this complex range from about 20 to 80 acres in size. The areas of the individual soils range from 3 to 5 acres in size. They are so intermingled that they could not be separated at the scale selected for mapping.

Nixa soils make up about 45 percent of each mapped area. Typically, the surface layer is very dark grayish brown very cherty silt loam about 2 inches thick. The subsurface layer is brown very cherty silt loam to a depth of about 11 inches. The subsoil in the upper part is light yellowish brown very cherty silt loam to a depth of about 22 inches. The middle part is a fragipan of brown, mottled very cherty silt loam to a depth of about 44 inches. The lower part is mottled yellowish red, strong brown, and light brownish gray very cherty silty clay loam to a depth of 72 inches or more.

Nixa soils are low in natural fertility and in content of organic matter. They are strongly acid or very strongly acid throughout. The permeability is very slow, and the available water capacity is low. Tilth is difficult to maintain, and the high content of chert fragments makes

the soil droughty and tillage operations difficult. The fragipan restricts root penetration and slows the movement of water through the soil.

Doniphan soils make up about 45 percent of each mapped area. Typically, the surface layer is dark brown very cherty silt loam about 1 inch thick. The subsurface layer is light yellowish brown very cherty silt loam to a depth of about 9 inches. The subsoil is strong brown very cherty silt loam to a depth of about 17 inches; yellowish red, mottled cherty silty clay to a depth of about 29 inches; dark red, mottled clay to a depth of about 56 inches; and mottled, dark red, strong brown, and light gray clay to a depth of 78 inches or more.

Doniphan soils are low in natural fertility and in content of organic matter. They range from slightly acid to strongly acid in the surface layer and are strongly acid or very strongly acid in the subsoil. The permeability is moderate, and the available water capacity is medium. Tilth is difficult to maintain. The very cherty surface and slope limit the use of some farm equipment. The root zone is deep, but the clayey subsoil restricts root penetration.

The remaining 10 percent of this complex consists of small areas of Gassville, Arkana, and Moko soils.

The soils in this complex are not suited to cultivated crops. Runoff is rapid, and erosion is a very severe hazard if cultivated crops are grown. These soils are used mainly for low grade upland hardwoods or pasture. These soils are moderately suited to pasture. The pasture plants adapted to these soils include tall fescue, white clover, bermudagrass, and lespedeza.

These soils are moderately suited to woodland use. The species adapted to these soils include shortleaf pine, loblolly pine, redcedar, and red oak. The erosion hazard and seedling mortality are moderate limitations to woodland use and management on Doniphan soils. Seedling mortality is a moderate limitation on Nixa soils.

Nixa soils have moderate limitations for dwellings and local roads and streets and severe limitations for small commercial buildings because of slope. Very slow permeability is a severe limitation for septic tank absorption fields. Doniphan soils have moderate limitations for dwellings because of slope and shrinking and swelling and severe limitations for small commercial buildings because of slope. Low strength is a severe limitation for local roads and streets. Moderate permeability is a moderate limitation for septic tank absorption fields. In most places, most of these limitations can be overcome by proper engineering design and installation.

The capability unit is VIIs-2. The woodland suitability group for Nixa soils is 4f8 and for Doniphan soils is 3r8.

30—Nixa-Noark complex, 3 to 8 percent slopes. This complex consists of Nixa and Noark soils on uplands and low ridges. The areas of this complex range from about 10 to 60 acres in size. The areas of the individual soils range from 3 to 5 acres in size. They are

so intermingled that they could not be separated at the scale selected for mapping.

Nixa soils make up about 50 percent of each mapped area. Typically, the surface layer is very dark grayish brown very cherty silt loam about 2 inches thick. The subsurface layer is brown very cherty silt loam to a depth of about 11 inches. The subsoil in the upper part is light yellowish brown very cherty silt loam to a depth of about 22 inches. The middle part is a fragipan of yellowish brown, mottled very cherty silt loam to a depth of about 44 inches. The lower part is mottled, yellowish red, strong brown, and light brownish gray very cherty silty clay loam to a depth of 72 inches or more.

Nixa soils are low in natural fertility and in content of organic matter. They are strongly acid or very strongly acid throughout. The permeability is very slow, and the available water capacity is low. Tilth is difficult to maintain, and the high content of chert fragments makes the soil droughty and tillage operations difficult. The fragipan restricts root penetration and slows the movement of water through the soil.

Noark soils make up about 40 percent of each mapped area. Typically, the surface layer is dark grayish brown very cherty silt loam about 4 inches thick. The subsurface layer is pale brown very cherty silt loam to a depth of about 18 inches. The subsoil is yellowish red very cherty silt loam to a depth of about 24 inches and red very cherty silty clay to a depth of about 72 inches or more.

Noark soils are low in natural fertility and organic matter content. They range from slightly acid to strongly acid in the surface layer and strongly acid or very strongly acid in the subsoil. The permeability is moderate, and the available water capacity is low. Tilth is difficult to maintain, and the high content of chert fragments makes tillage operations difficult. The root zone is deep and easily penetrated by roots.

The remaining 10 percent of this complex consists of small areas of Tonti and Captina soils.

The soils of this complex are moderately suited to cultivated crops. Runoff is medium to rapid, and erosion is a severe hazard if cultivated crops are grown. Adapted crops include small grains. With management that includes minimum tillage, terraces, and contour cultivation, crops that leave large amounts of residue can be safely grown year after year. Conservation treatment will need to be intensified as the length and grade of the slope increase. These soils are used mainly as woodland or improved pasture. They are moderately suited to pasture. The pasture plants adapted to these soils include tall fescue, white clover, bermudagrass, and lespedeza.

These soils are moderately suited to woodland use. The species adapted to these soils include shortleaf pine, loblolly pine, white oak, and red oak. Seedling mortality is a moderate limitation to woodland use and management.

Nixa soils have no significant limitations for dwellings and local roads and streets. Slope is a moderate

limitation for small commercial building sites. Very slow permeability is a severe limitation for septic tank absorption fields. Noark soils have no significant limitations for dwellings and local roads and streets. Slope is a moderate limitation for small commercial building sites. Moderate permeability is a moderate limitation for septic tank absorption fields. In most areas, most of these limitations can be overcome by proper engineering design and installation.

The capability unit is IIIs-1. The woodland suitability group is 4f8.

31—Nixa-Noark complex, 8 to 20 percent slopes.

This complex consists of Nixa and Noark soils on rolling uplands and low ridges. The areas of this complex range from about 20 to 80 acres in size. The areas of the individual soils range from 3 to 5 acres. They are so intermingled that they could not be separated at the scale selected for mapping.

Nixa soils make up about 45 percent of each mapped area. Typically, the surface layer is very dark grayish brown very cherty silt loam about 2 inches thick. The subsurface layer is brown very cherty silt loam to a depth of about 11 inches. The subsoil in the upper part is light yellowish brown very cherty silt loam to a depth of about 22 inches. The middle part is a fragipan of yellowish brown, mottled very cherty silt loam to a depth of about 44 inches. The lower part is mottled yellowish red, strong brown, and light brownish gray very cherty silty clay loam to a depth of 72 inches or more.

Nixa soils are low in natural fertility and in content of organic matter. They are strongly acid or very strongly acid throughout. The permeability is very slow, and the available water capacity is low. Tilth is difficult to maintain, and the high content of chert fragments makes the soil droughty and tillage operations difficult. The fragipan restricts root penetration and slows the movement of water through the soil.

Noark soils make up about 45 percent of each mapped area. Typically, the surface layer is dark grayish brown very cherty silt loam about 4 inches thick. The subsurface layer is pale brown very cherty silt loam to a depth of about 18 inches. The subsoil is yellowish red very cherty silt loam to a depth of about 24 inches and red very cherty silty clay to a depth of about 72 inches or more.

Noark soils are low in natural fertility and in content of organic matter. They range from slightly acid to strongly acid in the surface layer and are strongly acid or very strongly acid in the subsoil. The permeability is moderate, and the available water capacity is low. Tilth is difficult to maintain, and the high content of chert fragments makes tillage operations difficult.

The remaining 10 percent of this complex consists of small areas of Clarksville, Arkana, and Moko soils and areas where the slope is greater than 20 percent.

The soils in this complex are not suited to cultivated crops. Runoff is rapid, and erosion is a very severe

hazard. These soils are used mainly as woodland or improved pasture. They are moderately suited to pasture. The pasture plants adapted to these soils include tall fescue, white clover, bermudagrass, and lespedeza.

These soils are moderately suited to woodland use. The species adapted to these soils include shortleaf pine, loblolly pine, white oak, and red oak. Seedling mortality is a moderate limitation to woodland use and management.

Nixa and Noark soils have moderate limitations for dwellings and local roads and streets because of slope. Slope is a severe limitation for small commercial buildings on both soils. Nixa soils have very slow permeability, which is a severe limitation for septic tank absorption fields. Noark soils have moderate permeability, which is a moderate limitation for septic tank absorption fields. Most of these limitations can usually be overcome by proper engineering design and installation.

The capability unit is VI-2. The woodland suitability group is 4f8.

32—Noark very cherty silt loam, 3 to 8 percent slopes. This is a deep, well drained, gently sloping soil on uplands. Slopes are smooth and convex. Individual areas range from about 10 to 80 acres in size.

Typically, the surface layer is dark grayish brown very cherty silt loam about 4 inches thick. The subsurface layer is pale brown very cherty silt loam to a depth of about 18 inches. The subsoil is yellowish red very cherty silt loam to a depth of about 24 inches and red very cherty silty clay to a depth of 72 inches or more.

This soil is low in natural fertility and in content of organic matter. It ranges from slightly acid to strongly acid in the surface layer and is strongly acid or very strongly acid in the subsoil. The permeability is moderate, and the available water capacity is low. Tillage is difficult to maintain, and the high content of chert fragments makes tillage operations difficult. The root zone is deep and easily penetrated by roots.

Included with this soil in mapping are small areas of soils similar to Noark soils except that they have chert or limestone bedrock at a depth of less than 60 inches. Also included are small areas of Nixa, Tonti, Captina, and Arkana soils.

The soil in this unit is moderately suited to cultivated crops. The crops adapted to this soil include corn and small grains. Runoff is medium, and the hazard of erosion is severe if cultivated crops are grown. With management that includes minimum tillage, contour cultivation, and terraces, crops that leave large amounts of residue can be safely grown year after year. Conservation treatment measures will need to be intensified as the length and grade of the slope increase. This soil is used mainly for pasture and hay. It is well suited to pasture. The pasture plants adapted to this soil include tall fescue, white clover, bermudagrass, and lespedeza.

This soil is moderately suited to woodland use. The species adapted to this soil include shortleaf pine, red oak, and white oak. Seedling mortality is a moderate limitation for woodland use and management.

There are no significant limitations for dwellings and local roads and streets. Slope is a moderate limitation for small commercial buildings. In most areas, these limitations can be overcome by good design and careful installation. Moderate permeability is a moderate limitation for septic tank absorption fields. This limitation can usually be overcome by expanding the absorption fields or by modifying the field itself.

The capability unit is IIIe-4. The woodland suitability group is 4f8.

33—Noark very cherty silt loam, 8 to 20 percent slopes. This is a deep, well drained, moderately sloping to moderately steep soil on hillsides. Slopes are smooth and convex. Individual areas range from about 20 to 100 acres in size.

Typically, the surface layer is dark grayish brown very cherty silt loam about 4 inches thick. The subsurface layer is pale brown very cherty silt loam to a depth of about 18 inches. The subsoil is yellowish red very cherty silt loam to a depth of about 24 inches and red very cherty silty clay to a depth of 72 inches or more.

This soil is low in natural fertility and in content of organic matter. It ranges from slightly acid to strongly acid in the surface layer and is strongly acid or very strongly acid in the subsoil. The permeability is moderate, and the available water capacity is low. The root zone is deep and can be easily penetrated by roots.

Included with this soil in mapping are small areas of soils similar to Noark soils except that they have more chert or limestone bedrock at a depth of less than 60 inches. Also included are areas of Nixa, Clarksville, Arkana, and Moko soils.

The soil in this unit is not suited to cultivated crops. Runoff is rapid, and the erosion hazard is very severe. This soil is used mainly as woodland and pasture. It is moderately suited to pasture. The pasture plants adapted to this soil include tall fescue, white clover, lespedeza, and bermudagrass.

This soil is moderately suited to woodland use. The species adapted to this soil include shortleaf pine, red oak, and white oak. Seedling mortality is a moderate limitation to woodland use and management.

Slope is a moderate limitation for dwellings, a severe limitation for small commercial buildings, and a moderate limitation for local roads and streets. In most places, these limitations can be overcome by proper engineering design. Slope and moderate permeability are moderate limitations for septic tank absorption fields. In most places, these limitations can be overcome by good design and careful installation.

The capability unit is VIe-3. The woodland suitability group is 4f8.

34—Noark very cherty silt loam, 20 to 40 percent slopes. This is a deep, well drained, steep soil on hillsides. Slopes are smooth and convex. Individual areas range from about 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown very cherty silt loam about 4 inches thick. The subsurface layer is pale brown very cherty silt loam to a depth of about 14 inches. The subsoil is yellowish red very cherty silt loam to a depth of about 24 inches and red very cherty silty clay to a depth of 72 inches or more.

This soil is low in natural fertility and in content of organic matter. It ranges from slightly acid to strongly acid in the surface layer and is strongly acid or very strongly acid in the subsoil. The permeability is moderate, and the available water capacity is low. The root zone is deep and easily penetrated by roots.

Included with this soil in mapping are a few small areas of limestone outcrop and areas of soils similar to Noark soils except that they have limestone bedrock at a depth of less than 60 inches. Also included are areas of Clarksville, Estate, Arkana, and Moko soils.

The soil in this unit is not suited to cultivated crops or improved pasture. Runoff is rapid, and the hazard of erosion is very severe. This soil is suited to woodland use, wildlife habitat, and rangeland. Tame pasture plants are difficult to establish and maintain. This soil is used mainly for upland hardwoods and pines.

This soil is moderately suited to woodland use. The species adapted to this soil include shortleaf pine, red oak, and white oak. The erosion hazard and seedling mortality are moderate limitations, and equipment limitations are severe for woodland use and management.

This soil has severe limitations for most urban uses. Steep slopes are a severe limitation for sites for dwellings and small commercial buildings, roads and streets, and septic tank absorption fields. This limitation is difficult or impractical to overcome.

The capability unit is VIIIs-2. The woodland suitability group is 4r9.

35—Portia fine sandy loam, 3 to 8 percent slopes. This is a deep, well drained, gently sloping soil on uplands and foot slopes. Slopes are smooth and convex. Individual areas range from about 10 to 50 acres in size.

Typically, the surface layer is brown fine sandy loam about 4 inches thick. The subsoil is dark brown fine sandy loam to a depth of about 10 inches, reddish brown sandy clay loam to a depth of about 20 inches, and red sandy clay loam to a depth of 72 inches or more.

This soil is low in natural fertility and in content of organic matter. It ranges from slightly acid to strongly acid in the surface layer and upper part of the subsoil and from medium acid to very strongly acid in the lower part of the subsoil. The permeability is moderately slow, and the available water capacity is medium. This soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep and easily penetrated by roots.

Included with this soil in mapping are areas where the soil is stony and gravelly, small areas of Estate soils, some shallow gullies, and small areas where the soil is eroded.

The soil in this unit is moderately suited to cultivated crops. The crops adapted to this soil include corn, small grains, and truck crops. Runoff is medium, and the hazard of erosion is severe if cultivated crops are grown. With management that includes minimum tillage, contour cultivation, and terraces, crops that leave large amounts of residue on the surface can be safely grown year after year. Conservation treatment needs to be intensified as the length and grade of the slope increase. This soil is used mainly for pasture or hay. It is well suited to pasture. The pasture plants adapted to this soil include tall fescue, white clover, bahiagrass, bermudagrass, and lespedeza.

This soil is well suited to woodland use. The species adapted to this soil include shortleaf pine, white oak, red oak, and sweetgum. There are no significant limitations to woodland use and management.

There are no significant limitations for dwellings. Slope is a moderate limitation for small commercial buildings. Low strength is a moderate limitation for local roads and streets. In most places, these limitations can be overcome by good engineering design and careful installation. Moderate permeability is a moderate limitation for septic tank absorption fields, but in most areas, this limitation can be overcome by increasing the size of the absorption field.

The capability unit is IIIe-2. The woodland suitability group is 3o7.

36—Portia fine sandy loam, 8 to 12 percent slopes. This is a deep, well drained, moderately sloping soil on foot slopes and uplands. Slopes are smooth and convex. Individual areas range from about 10 to 30 acres in size.

Typically, the surface layer is brown fine sandy loam about 4 inches thick. The subsoil is dark brown fine sandy loam to a depth of about 10 inches, reddish brown sandy clay loam to a depth of about 20 inches, and red sandy clay loam to a depth of 72 inches or more.

This soil is low in natural fertility and in content of organic matter. It ranges from slightly acid to strongly acid in the surface layer and upper part of the subsoil and medium acid to very strongly acid in the lower part of the subsoil. The permeability is moderately slow, and the available water capacity is medium. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep and easily penetrated by roots.

Included with this soil in mapping are areas where the soils are stony and gravelly, small areas of Estate and Moko soils, some gullies, and small areas where the soil is eroded.

The soil in this unit is poorly suited to cultivated crops. Runoff is rapid, and the hazard of erosion is very severe if cultivated crops are grown. With management that

includes minimum tillage, terraces, and contour cultivation, sown crops can be grown occasionally in a cropping system that includes close growing cover most of the time. Conservation treatment needs to be intensified as the length and grade of the slope increase. This soil is used mainly for pasture and hay. It is well suited to pasture. The pasture plants adapted to this soil include tall fescue, white clover, lespedeza, bahiagrass, and bermudagrass.

This soil is well suited to woodland use. The species adapted to this soil include shortleaf pine, red oak, and sweetgum. There are no significant limitations to woodland use and management.

Slope is a moderate limitation for dwellings. Slope and low strength are moderate limitations for local roads and streets. Slope is a severe limitation for small commercial buildings. These limitations can be overcome by good engineering design and careful installation. Slope and moderate permeability are moderate limitations for septic tank absorption fields. In most places, these limitations can be overcome by increasing the size of the absorption field.

The capability unit is IVE-2. The woodland suitability group is 3o7.

37—Razort silt loam, frequently flooded. This is a level to nearly level, deep, well drained, frequently flooded soil on flood plains and low terraces paralleling small streams. Individual areas range from about 5 to 40 acres in size. Slope ranges from 0 to 3 percent.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil is dark brown loam to a depth of about 33 inches, dark yellowish brown gravelly loam to a depth of about 41 inches, and dark brown silty clay loam to a depth of about 58 inches. The underlying material is very gravelly loamy sand to a depth of 85 inches or more.

This soil is moderate in natural fertility and in content of organic matter. It is neutral or slightly acid in the surface layer and slightly acid or medium acid in the subsoil. The permeability is moderate, and available water capacity is high. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep and easily penetrated by roots. In most years, this soil is flooded in most areas from January to April. It is flooded for very brief periods by fast-moving water, which can cause severe damage.

Included with this soil in mapping are small areas of Elsah, Healing, and Wideman soils, small areas of sandy overwash, areas that are somewhat poorly drained, and areas with a gravelly surface layer.

This soil is poorly suited to cultivated crops, mainly because the hazard of flooding is severe. Good yields can be obtained of late maturing crops in some years. The crops adapted to this soil include corn, soybeans, small grains, and truck crops. This soil is used mainly for pasture and hay. It is well suited to pasture (figs. 9 and 10). The

adapted pasture plants include bermudagrass, tall fescue, white clover, alfalfa, and lespedeza.

This soil is well suited to woodland use. The species adapted to this soil include shortleaf pine, loblolly pine, red oak, white oak, sweetgum, cottonwood, black walnut, and sycamore. There are no significant limitations to woodland use and management.

This soil has severe limitations for most urban uses. Flooding is a severe hazard for dwellings, small commercial buildings, local roads and streets, and septic tank absorption fields. Major flood control practices are needed to overcome this limitation.

The capability unit is Vw-2. The woodland suitability group is 2o7.

38—Sldon silt loam, 3 to 8 percent slopes. This is a deep, moderately well drained, gently sloping soil on broad mountaintops. Slopes are smooth and convex. Individual areas range from about 20 to 200 acres in size.

Typically, the surface layer is yellowish brown silt loam about 7 inches thick. The subsoil in the upper part is strong brown silty clay loam to a depth of about 21 inches. The middle part is a fragipan of yellowish brown, mottled silt loam to a depth of 33 inches and of mottled, strong brown, gray, and red gravelly clay loam to a depth of 44 inches. The lower part is mottled, gray, strong brown, and red very gravelly clay loam to a depth of about 58 inches. Below this is hard, level-bedded, acid sandstone.

This soil is low in natural fertility and in content of organic matter. It is strongly acid or very strongly acid throughout, unless the surface layer has been limed. The permeability is slow, and the available water capacity is high. The soil has good tilth and can be worked throughout a wide range of moisture conditions. A water table is perched above the fragipan in late winter and early spring. The fragipan restricts root penetration and slows the movement of water through the soil.

Included with this soil in mapping are small areas of Mountainburg soils, small areas where the surface layer is gravelly, and areas where the slope is less than 3 percent.

The soil in this unit is moderately suited to cultivated crops. The crops adapted to this soil include corn and small grains. Runoff is medium, but erosion is a hazard if cultivated crops are grown. With management that includes minimum tillage, contour cultivation, and terraces, crops that leave large amounts of residue can be safely grown year after year. Conservation treatment needs to be intensified as length and grade of the slope increase. This soil is used mainly for hay and pasture. It is well suited to pasture. The pasture plants adapted to this soil include bermudagrass, bahiagrass, lespedeza, tall fescue, and white clover.

This soil is well suited to woodland use. The species adapted to this soil include shortleaf pine, red oak, white oak, and loblolly pine. There are no significant limitations to woodland use and management.



Figure 9.—Late maturing sorghum-sudan hybrid hay on Razort silt loam, frequently flooded. Late maturing varieties must be planted because this soil is flooded early in spring.

Wetness is a moderate limitation for dwellings. Low strength and wetness are moderate limitations for local roads and streets. Wetness and slope are moderate limitations for small commercial buildings. These limitations can be overcome by proper engineering design and drainage. Slow permeability and wetness are severe limitations for septic tank absorption fields. This limitation can be partially overcome by increasing the size of the absorption area or by modifying the absorption field.

The capability unit is 111e-3. The woodland suitability group is 3o7.

39—Tonti cherty silt loam, 3 to 8 percent slopes.

This is a deep, moderately well drained, gently sloping soil on broad uplands. Slopes are smooth and convex. Individual areas range from about 5 to 80 acres in size.

Typically, the surface layer is brown cherty silt loam about 7 inches thick. The subsoil in the upper part is strong brown cherty silt loam to a depth of about 19 inches. The middle part is a compact and brittle fragipan of strong brown, mottled very cherty silt loam to a depth of about 32 inches. The lower part is red, mottled clay to a depth of 72 inches or more.

This soil is low in natural fertility and in content of organic matter. It is strongly acid or very strongly acid throughout, unless the surface layer has been limed. The permeability is slow, and the available water capacity is medium. Tilth is good, and the soil can be worked throughout a wide range of moisture content. The cherty surface slightly hinders tillage operations. A water table is perched above the fragipan in late winter and early spring. The fragipan restricts root penetration and slows the movement of water through the soil.

Included with this soil in mapping are small areas of Captina, Doniphan, Nixa, and Noark soils, and a few small areas where the soil is eroded.

The soil in this unit is moderately suited to cultivated crops. Runoff is medium to rapid, and the hazard of erosion is severe if cultivated crops are grown. The crops adapted to this soil include small grains, corn, and truck crops. With management that includes minimum tillage, contour cultivation, and terraces, clean-tilled crops that leave large amounts of residue on the surface can be safely grown year after year. Conservation treatment needs to be intensified as length and grade of the slope increase. This soil is used mainly for pasture and hay. It is well suited to pasture. The pasture plants adapted to this soil include tall fescue, white clover, bermudagrass, and lespedeza.

This soil is moderately suited to use as woodland. The species adapted to this soil include shortleaf pine, red

oak, and eastern redcedar. There are no significant limitations to woodland use and management.

Wetness is a moderate limitation for dwellings. Wetness and slope are moderate limitations for small commercial buildings. Wetness is a moderate limitation for local roads and streets. These limitations can be overcome by proper engineering design and drainage. Slow permeability and wetness are severe limitations for septic tank absorption fields. This limitation can be partially overcome by increasing the size of the absorption area or by modifying the absorption field.

The capability unit is IIIe-3. The woodland suitability group is 4o7.

40—Udorthents-Ramsey-Rock outcrop complex, 3 to 20 percent slopes. This complex consists of Udorthents, Ramsey soils, and Rock outcrop in small areas on uplands and side slopes. The areas are so intermingled that they could not be separated at the



Figure 10.—An area of Razort silt loam, frequently flooded. In some years late maturing crops, for example, forage sorghum, do well.

scale selected for mapping. Mapped areas range from about 5 to 60 acres in size, and the areas of the individual soils range from 1 to 3 acres in size.

Udorthents make up about 40 percent of each mapped area. Typically, dark brown fine sandy loam, 2 to 12 inches thick, overlies bedrock of hard, acid sandstone. A few sandstone fragments 2 to 10 inches in diameter are on or below the surface.

Udorthents are very low in natural fertility and in content of organic matter. They are strongly acid or very strongly acid throughout. The permeability is rapid, and the available water capacity is very low.

Ramsey soils make up about 30 percent of each mapped area. Typically, the surface layer of Ramsey soils is dark brown stony sandy loam about 1 inch thick. The subsurface layer is brown stony sandy loam; it extends to a depth of about 7 inches. The subsoil is yellowish brown stony sandy loam; it extends to a depth of about 13 inches. Below that, there is hard, level-bedded, acid sandstone.

Ramsey soils are low in natural fertility and in content of organic matter. They are strongly acid or very strongly acid throughout. The permeability is rapid, and the available water capacity is low.

Rock outcrop makes up about 25 percent of each mapped area. The rock is hard, acid sandstone.

The remaining 5 percent of this complex consists of small areas of stony Estate and Portia soils, areas where the slopes are greater than 20 percent, areas of sandstone escarpments, and areas where there are massive sandstone boulders, 5 to 30 feet in diameter.

The soils in this complex are not suited to cultivated crops or improved pasture. Depth to bedrock, large stones on the surface, and rock outcrops are limitations to use of these soils as wildlife habitat, rangeland, woodland, or recreation areas. These soils should not be cleared. Erosion is a very severe hazard if the native vegetation is disturbed. Most of the areas are wooded. Low grade scrub redcedar, pine, and hardwoods are scattered throughout, and some native prairie plants, lichens, mosses, and cacti and other succulents grow in the openings.

Udorthents are not suited to woodland use, and Ramsey soils are poorly suited. Species adapted to the Ramsey soils include shortleaf pine, loblolly pine, and redcedar. Seedling mortality, the erosion hazard, and equipment limitations are severe.

The limitations for most urban uses are severe. Depth to bedrock, stones on the surface, and rock outcrops severely limit the use of the soils for dwellings, small commercial buildings, roads, streets, and septic tank absorption fields. The limitations are difficult or impractical to overcome.

The capability unit is VIIIs-4. Ramsey soils are in woodland suitability group 5x9.

41—Ventrils cherty silt loam, 3 to 8 percent slopes. This is a moderately deep, moderately well drained,

gently sloping soil on uplands. Slopes are smooth and convex. Individual areas range from about 40 to 200 acres in size.

Typically, the surface layer is very dark grayish brown cherty silt loam about 1 inch thick. The subsurface layer is brown cherty silt loam to a depth of about 5 inches. The subsoil is yellowish brown clay with light brownish gray and yellowish red mottles to a depth of 17 inches; yellowish brown clay with light brownish gray mottles to a depth of 32 inches; and highly weathered, soft dolomite to a depth of 34 inches. Below this, there is level-bedded, highly fractured, hard dolomite bedrock.

This soil is low in natural fertility and in content of organic matter. Reaction ranges from medium acid to neutral in the surface layer and upper part of the subsoil and from slightly acid to mildly alkaline in the lower part. The permeability is very slow, and the available water capacity is low. Tillage is difficult to maintain, and the cherty surface layer limits the use of some tillage equipment. The high clay content of the subsoil restricts root penetration and slows the movement of water through the soil.

Included with this soil in mapping are small areas of Arkana, Captina, Doniphan, and Moko soils, small areas where the surface layer is silt loam, and small areas where the soil is deeper than 40 inches to bedrock.

The soil in this unit is poorly suited to cultivated crops. The crops adapted to this soil include small grains. Runoff is medium, and erosion is a very severe hazard if cultivated crops are grown. With management that includes minimum tillage, contour cultivation, and terraces, crops that leave large amounts of residue can be grown occasionally in a cropping system that keeps close-growing cover on the soil most of the time. This soil is used mainly for low grade hardwoods and redcedar or for pasture. It is poorly suited to hay and pasture. The pasture plants adapted to this soil are tall fescue, orchardgrass, lespedeza, and white clover.

This soil is poorly suited to woodland use. The species adapted to this soil are eastern redcedar and shortleaf pine. Seedling mortality is a moderate limitation.

Ventrils soils have severe limitations for most urban uses. Low strength and a high shrink-swell potential are severe limitations for roads and streets. A high shrink-swell potential is a severe limitation for dwellings and small commercial buildings. In most places, these limitations can be overcome by proper engineering design and installation. Very slow permeability and depth to bedrock are severe limitations for septic tank absorption fields. These limitations are difficult or impractical to overcome.

The capability unit is IVe-4. The woodland suitability group is 5c2.

42—Wideman sandy loam, frequently flooded. This is a deep, excessively drained level to gently sloping soil on flood plains and natural levees. Slopes range from 0 to 5 percent. The landscape is smooth and undulating.

Individual areas are long and narrow and range from about 5 to 40 acres in size.

Typically, the surface layer is dark yellowish brown sandy loam about 6 inches thick. The underlying material is light yellowish brown loamy sand to a depth of about 15 inches; very pale brown loamy sand to a depth of 24 inches; light yellowish brown loamy sand to a depth of 27 inches; dark yellowish brown gravelly sandy loam to a depth of 30 inches; very pale brown loamy sand to a depth of 43 inches; light yellowish brown loamy sand to a depth of 52 inches; and very pale brown sand to a depth of 80 inches or more.

This soil is low in natural fertility and organic matter. It ranges from medium acid to mildly alkaline throughout. The permeability is moderately rapid, and the available water capacity is low. This soil can be worked over a wide range of moisture content. The root zone is deep and easily penetrated by roots. This soil is droughty in summer. In most years, this soil is flooded in most areas in the early spring months. It is flooded for very brief periods by fast-moving water, which can cause severe damage.

Included with this soil in mapping are small areas of Healing and Razort soils. Also included are areas of loamy sand overwash, narrow overflow channels, and gravel bars.

This soil is not suited to cultivated crops. The hazard of flooding and the low available water capacity severely limit the use of this soil for crop production. This soil is used mainly for hay or improved pasture. It is moderately suited to pasture. The pasture plants adapted to this soil include bermudagrass, lespedeza, alfalfa, tall fescue, and white clover.

This soil is moderately suited to woodland use. The species adapted to this soil include loblolly pine, shortleaf pine, sweetgum, cottonwood, and sycamore. Equipment limitations and seedling mortality are moderate limitations to woodland use and management.

This soil has severe limitations for most urban uses. Flooding is a severe hazard for dwellings, small commercial buildings, local roads and streets, and septic tank absorption fields. Major flood control practices are needed to overcome this limitation.

The capability unit is Vw-3. The woodland suitability group is 3s8.

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

W. Wilson Ferguson, conservation agronomist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated

yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 126,000 acres in the survey area was used for crops and pasture in 1974, according to the Census of Agriculture. Of that total, about 14,000 acres was harvested cropland and 67,000 acres of cropland was used for pasture. In addition, about 45,000 acres was improved and unimproved pasture, range, and woodland pasture.

Most cleared areas in the two county area are presently used for pasture and hay production. The acreage in clean tilled row crops is small. Areas well suited to row crops are bottom land and terraces along the White and Norfolk Rivers, terraces above the flood plains along smaller streams, and a few, small nearly level areas on uplands. Row crops suited to these areas are soybeans, corn, and small grains.

Some gently sloping to moderately sloping upland soils are moderately suited to well suited to drilled or sown crops, such as oats, wheat, and grain sorghum.

Most soils in the survey area are poorly suited or not suited to intensive use because of surface stones, slopes, shallow depth to bedrock, high content of coarse fragments in the soil, or a combination of these features.

Contour cultivation, vegetated waterways, and terraces are needed on sloping soils used for tilled crops. Annual cover crops or grasses and legumes should be grown regularly in the cropping system if the hazard of erosion is severe or very severe.

Most of the soils, if left bare, tend to pack and crust after heavy rains. Cover crops and crop residue help to maintain good tilth. Crop residue should be shredded and spread evenly to provide a protective cover and add active organic matter to the soil. Minimum tillage should be practiced to the extent practical for the soil conditions and the crop requirement.

In general, the upland soils of the two counties are low in nitrogen, potassium, phosphorus, and calcium and in organic matter. The kinds and amounts of fertilizer applied are generally based on soil tests, kinds of crops to be grown, past experience, capability of the soil to produce, and expected yields. On most soils, lime helps

most crops if it is periodically applied according to needs indicated by soil tests. It is generally necessary for satisfactory yields of alfalfa, white clover, red clover, vegetables, and other specialty crops.

The acreage in commercial and home orchards and home gardens is small, but the cash income from them is important. Most farm families, as well as many urban families, can and freeze homegrown fruit and vegetables for home use. Specialty crops—watermelons, strawberries, tomatoes, and sweetcorn—are sold at local farmers' markets.

Perennial grasses or mixtures of grasses and legumes are grown for pasture and hay. Mixtures generally consist of either a warm season or a cool season perennial grass and a suitable legume.

Tall fescue, the most commonly grown pasture grass in the survey area, is a cool season perennial propagated by seeding, generally in the fall. Common bermudagrass, hybrid bermudagrasses, and lovegrass are also grown. These are warm season perennials propagated by either seeding or sprigging, generally in the spring. The bermudagrasses are usually sprigged because stands started by seeding are susceptible to winterkill. Red clover and white clover are the most commonly grown legumes. Alfalfa is suited to the fertile, well drained Healing, Razort, and Britwater soils on bottom lands along major streams.

Proper grazing is essential for the production of high quality forage, stand survival, and erosion control. Proper grazing requires maintaining sufficient top growth on the plants during the growing season to provide for vigorous healthy growth. It also may require restricting grazing of tall fescue and other cool season grasses during the hot dry summer months. Brush control is essential, and weed control is generally needed. Rotation grazing and renovation are also important.

Pasture grasses respond well to nitrogen fertilizer. Grass and legume mixtures may require phosphate and potash fertilizers and agricultural lime applied at rates based on soil test results.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 7. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties;

appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 7 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-2 or IIIe-3.

The capability classification of each map unit is given in the section "Detailed soil map units."

woodland management and productivity

Paul I. Brown, forester, Soil Conservation Service, helped prepare this section.

The Baxter and Marion Counties area was originally wooded. The early settlers cleared and farmed substantial areas. During the late 1800's and early 1900's, however, the wooded acreage increased. This trend peaked in the 1950's, when approximately 75 percent of the survey area was wooded. In 1970, trees covered 536,800 acres or 69 percent of the area (10). Of this wooded acreage, various government agencies owned about 19 percent or 104,000 acres; principally, they were the Forest Service, the Park Service, and the Corps of Engineers. Small, private nonindustrial landowners owned the rest. During the 1970's, more privately owned forestland was converted to farmland, mainly pastureland.

The area produces good to poor stands of commercial trees. Generally, the better stands are located in stream bottoms and on north-facing slopes. Broad-leaved species dominate the wooded areas; however, there are scattered stands of needle-leaved species and a sizeable area of shortleaf pine south of the White River

in Baxter County and in the Buffalo River area in Marion County. Eastern redcedar is common on the shallow soils in the northern portion of both counties.

The area lacks markets for major forest products. Consequently, the economic impact of wood products is small. Minor forest products from the area include lumber for furniture, crossties, fenceposts, and handles. The forest land has great aesthetic and recreation value. It also provides wildlife habitat, grazing for domestic animals, and soil and water conservation.

This section explains how soils affect the growth of trees and the management of timber resources in the county.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the woodland suitability group symbol for each soil. Soils assigned the same woodland suitability group symbol require the same general management and have about the same potential productivity.

The first part of the *woodland suitability group*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: *x*, *w*, *t*, *d*, *c*, *s*, *f*, and *r*.

The third element in the symbol, a numeral, indicates the kind of trees for which the soils in the group are best suited and also indicates the severity of the hazard or limitation. The numerals 1, 2, and 3 indicate slight, moderate, and severe limitations, respectively, and suitability for needleleaf trees. The numerals 4, 5, and 6 indicate slight, moderate, and severe limitations, respectively, and suitability for broadleaf trees. The numerals 7, 8, 9 indicate slight, moderate, and severe limitations, respectively, and suitability for both needleleaf and broadleaf trees.

In table 8, *slight*, *moderate*, and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland

management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. Site index was determined at age 30 for eastern cottonwood, age 35 for American sycamore, and age 50 for all other species. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

recreation

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

wildlife habitat

Paul M. Brady, biologist, Soil Conservation Service, helped prepare this section.

In Baxter and Marion Counties, the Ozark Mountains provide habitat for all of Arkansas' major game animals and many nongame animals. However, because of a lack of interspersed and variety in land use, the populations of certain species, especially whitetail deer, wild turkey, and bobwhite quail, have been low in recent years.

Approximately 69 percent of the counties, or 536,000 acres, is in forests, mainly mixed oak, hickory, and other hardwoods and some shortleaf pine and redcedar. Besides deer and turkey, gray squirrel, coyote, bobcat, opossum, raccoon, and various hawks, owls, and woodland songbirds also inhabit these forests.

Songbirds and game animals are generally abundant in the northern portions of Baxter and Marion Counties.

Open glades of native grasses, weeds, and scattered redcedars mixed with pastures, hayfields, and forests provide a great variety of habitat.

The fishery resources in these counties are extensive and in some areas provide excellent sportfishing. Bull Shoals Lake, which covers about 35,440 acres in the survey area, and Norfolk Lake, which covers about 26,000 acres in the survey area, are in the northern parts of Marion and Baxter Counties, respectively, and extend into Missouri.

Bull Shoals provides sportfishing for largemouth bass, smallmouth bass, channel catfish, crappies, and bluegill and other sunfish. Norfolk Lake also provides fishing for largemouth bass, white bass, walleye, bluegill, crappies, channel catfish, and other game fish. Night fishing with lights for white bass and crappies is especially popular on this lake.

The White River, flowing south from Bull Shoals Dam, is a world famous trout stream. The cold water release from Bull Shoals Lake provides good downstream habitat for rainbow trout and brown trout. Fishing resorts, boat rentals, and guide services abound on this stretch of the river.

Crooked Creek, one of the state's best smallmouth bass streams, flows west to east across Marion County before joining the White River. The Buffalo River, world famous for its canoeing and float fishing, flows through the southeast corner of Marion County. Besides smallmouth bass, both of these streams contain rock bass and other sunfish and various minnows and darters.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or

maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are

created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, and bear.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, shore birds, muskrat, mink, and beaver.

engineering

James L. Janski, assistant state conservation engineer, Soil Conservation Service, helped prepare this section.

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging,

filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

sanitary facilities

Table 12 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less

desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered

daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good*, *fair*, or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil

layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high,

constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone; the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a

cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such

as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture (8). These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (2) and the system

adopted by the American Association of State Highway and Transportation Officials (1).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and plasticity index (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent.

Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

physical and chemical properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

soil and water features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and

on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

physical and chemical analyses of selected soils

The results of physical analysis of several typical pedons in the survey area are given in table 18 and the results of chemical analysis in table 19. The data are for soils sampled at carefully selected sites. The pedons are typical of the series and are described in the section "Soil series and their morphology." Soil samples were analyzed by the University of Arkansas, Fayetteville, Arkansas.

Most determinations, except those for grain-size analysis and bulk density, were made on soil material smaller than 2 millimeters in diameter. Measurements reported as percent or quantity of unit weight were calculated on an oven-dry basis. The methods used in obtaining the data are indicated in the list that follows.

The silt and clay particle size distribution was determined by the hydrometer method (6). Sands were measured by sieving (9).

The organic carbon of the Brockwell and Estate samples was determined by the dry combustion method, which measures carbon dioxide evolution gravimetrically (9). The percentage of organic matter was then determined by multiplying the percentage of organic carbon by 1.72. The organic matter of the Nixa sample was determined by a modified Walkley-Black method (6). The organic matter is reduced with potassium dichromate-sulfuric acid, and the quantity of chromic acid reduced is measured colorimetrically.

Soil pH was determined on a 1:1 soil to water mixture.

The bases were extracted with 1N, pH 7.0, ammonium acetate. Calcium, potassium, and sodium were determined with a flame-photometer, and magnesium was measured by atomic absorption. The extractable acidity was determined by the barium chloride-triethanolamine method (9).

The total extractable calcium, potassium, magnesium,

sodium, and extractable acidity is an approximation of the cation-exchange capacity of the soil. Except in soils that contain soluble salts, base saturation was

determined by dividing this total into the sum of calcium, potassium, magnesium, and sodium, and multiplying by 100.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (11). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 20, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Ultisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udult (*Ud*, meaning humid, plus *ult*, from Ultisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludults (*Hapl*, meaning minimal horizonation, plus *udult*, the suborder of the Ultisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typical subgroup. Other subgroups are intergrades or extragrades. The typical is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludults.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties

and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is clayey, mixed, mesic Typic Hapludults.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (8). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (11). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Arkana series

The Arkana series consists of moderately deep, well drained, very slowly permeable soils that formed in clayey residuum of weathered cherty dolomite or cherty limestone bedrock. These are gently sloping to steep soils on uplands. The native vegetation is mixed low grade upland hardwoods and redcedar. Slope ranges from 3 to 30 percent.

Arkana soils are geographically associated with Clarksville, Doniphan, Gassville, Healing, Moko, and Ventris soils. Clarksville soils are on steep side slopes at higher elevations. They are more than 60 inches deep to

bedrock and have a loamy-skeletal control section. Doniphan soils are on adjacent similar landscapes. They are deeper than 40 inches to bedrock and have less than 35 percent base saturation. Gassville soils are on adjacent steep side slopes. They have less than 35 percent base saturation and are deeper than 40 inches to bedrock. Healing soils are on adjacent terraces. They have a fine-silty control section and are deeper than 40 inches to bedrock. Moko soils are on adjacent similar landscapes. They are less than 20 inches deep to bedrock and do not have an argillic horizon. Ventris soils are on adjacent gently sloping landscapes. They have an abrupt textural change from the A horizon to the B horizon and have a browner subsoil.

Typical pedon of Arkana very cherty silt loam, from an area of Arkana-Moko complex, 3 to 8 percent slopes, in a wooded area in the NW1/4SE1/4SE1/4 sec. 13, T. 20 N., R. 13 W. in Baxter County:

- O1—1 inch to 0; hardwood leaves and twigs.
- A11—0 to 4 inches; very dark grayish brown (10YR 3/2) cherty silt loam; moderate medium granular structure; very friable; many fine and medium roots; common fine pores; 45 percent chert fragments; mildly alkaline; clear wavy boundary.
- A12—4 to 7 inches; dark brown (10YR 3/3) very cherty silt loam; moderate medium granular structure; friable; many fine and medium roots; common fine pores; 45 percent chert fragments; mildly alkaline; abrupt wavy boundary.
- A2—7 to 11 inches; brown (10YR 4/3) very cherty silt loam; weak medium granular structure; friable; many fine and medium roots; common fine pores; 55 percent chert fragments; medium acid; clear wavy boundary.
- B21t—11 to 15 inches; yellowish red (5YR 4/6) very cherty silty clay; weak medium subangular blocky structure; firm; common thin patchy clay films; few fine and medium roots; common fine tubular pores; 50 percent chert fragments; strongly acid; clear wavy boundary.
- B22t—15 to 21 inches; yellowish red (5YR 5/6) cherty clay; few fine faint yellowish brown mottles; moderate fine subangular blocky structure; firm, plastic; 30 percent chert fragments; few fine black concretions; thin continuous clay films; few fine roots; few fine tubular pores; medium acid; diffuse boundary.
- B23t—21 to 27 inches; dark yellowish brown (10YR 4/4) clay; weak coarse angular blocky structure; very firm, plastic; thick continuous clay films; few medium roots; few fine pores; 10 percent chert fragments; few fine black concretions; moderately alkaline; abrupt smooth boundary.
- R—27 to 29 inches; hard, level-bedded dolomite bedrock; cracks in bedrock are more than 4 inches apart.

The solum ranges from 20 to 40 inches in thickness. The A horizon is medium acid to mildly alkaline, and the B horizon is strongly acid to moderately alkaline.

The A1 horizon ranges from 5 to 9 inches in thickness. The A1 horizon has hue of 10YR, value of 2 or 3, and chroma of 1, 2, or 3. The A2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The content of coarse fragments in the A1 and A2 horizons ranges from 35 to 60 percent.

The B1 horizon, where present, has hue of 7.5YR, value of 5, and chroma of 4 or 6, or hue of 5YR, value of 4 or 5, and chroma of 4 or 6. It is very cherty silty clay loam or very cherty silt loam.

The B21t and B22t horizons have matrix colors in hue of 7.5YR and value of 4 and chroma of 4 or value of 5 and chroma of 4, 6, or 8; or hue of 5YR and value of 4 and chroma of 4 or 6 or value of 5 and chroma of 4, 6, or 8.

The B23t horizon has matrix colors in hue of 10YR and value of 4 and chroma of 4 or 6 or value of 5 and chroma of 4, 6, or 8; or hue of 7.5YR and value of 4 and chroma of 4 or value of 5 and chroma of 4, 6, or 8; or hue of 5YR and value of 4 and chroma of 4 or 6 or value of 5 and chroma of 4, 6, or 8.

The B21t horizon is clay loam, silty clay, or clay or the cherty or very cherty analogs. The content of coarse fragments ranges from 10 to 60 percent. The B22t and B23t horizons are clay or cherty clay, and their content of coarse fragments ranges from 0 to 35 percent. The B22t and B23t horizons commonly have mottles or relict fragments of bedrock in shades of brown or yellow.

The R horizon is hard, level-bedded dolomite or limestone bedrock.

Britwater series

The Britwater series consists of deep, well drained, moderately permeable soils that formed in old alluvial sediment and residuum of weathered cherty limestone or cherty dolomite. These are nearly level to gently sloping soils on stream terraces and uplands. Slope ranges from 1 to 8 percent.

Britwater soils are geographically associated with Doniphan, Healing, Razort, and Wideman soils. Doniphan soils are on adjacent higher upland positions. They have less than 35 percent base saturation and clayey control section. Healing soils are on adjacent lower terraces and have a mollic epipedon and fine-silty control section. Razort soils are on adjacent lower flood plains and have mollic colors in the A horizon and have a browner subsoil. Wideman soils are on adjacent lower flood plains. They have a sandy control section.

Typical pedon of Britwater silt loam, 3 to 8 percent slopes, in an idle pasture in the NW1/4SW1/4SE1/4 sec. 9, T. 20 N., R. 13 W. in Baxter County:

- Ap—0 to 7 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine subangular blocky structure; friable;

common fine roots; slightly acid; clear smooth boundary.

B1—7 to 14 inches; dark brown (7.5YR 4/4) silt loam; weak medium subangular blocky structure; friable; few fine roots; common fine and medium pores; few very fine black concretions; medium acid; clear smooth boundary.

B21t—14 to 24 inches; yellowish red (5YR 4/6) silty clay loam; moderate medium subangular blocky structure; friable; common thin patchy clay films on faces of peds and lining pores; 5 percent fine chert pebbles; few fine pores; few fine black concretions; medium acid; clear smooth boundary.

B22t—24 to 33 inches; yellowish red (5YR 4/6) gravelly silty clay loam; moderate medium subangular blocky structure; friable; thin continuous clay films on faces of peds; common medium pores; 15 percent fine chert pebbles; common black stains; medium acid; gradual smooth boundary.

B23t—33 to 50 inches; red (2.5YR 4/6) gravelly silty clay loam; common medium distinct brown (7.5YR 5/4) mottles; moderate medium subangular blocky structure; friable; thin continuous clay films on faces of peds; common medium and large pores; 20 percent fine chert pebbles; common black stains; strongly acid; gradual smooth boundary.

B24t—50 to 63 inches; red (2.5YR 4/6) gravelly clay loam; few medium distinct brown (7.5YR 5/4) mottles; moderate medium subangular blocky structure; friable; thin continuous clay films on faces of peds; common medium and large pores; 25 percent chert pebbles; common black stains; strongly acid; gradual smooth boundary.

B25t—63 to 76 inches; red (2.5YR 4/6) very gravelly silty clay; moderate fine angular blocky structure; firm; thick continuous clay films on faces of peds; 50 percent chert pebbles; common black stains; common fine black concretions; strongly acid.

The solum ranges from 60 to more than 80 inches in thickness. Reaction is medium acid or strongly acid throughout, except where the surface layer has been limed.

The A horizon ranges from 5 to 8 inches in thickness. The A horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam or gravelly silt loam. The content of gravel ranges from 0 to 20 percent.

The B1 horizon, where present, is 3 to 7 inches thick. It has hue of 10YR, value of 4 or 5, and chroma of 4; or hue of 7.5YR, value of 4, and chroma of 4. It is silt loam, loam, gravelly loam, or gravelly silt loam. The content of coarse fragments ranges from 0 to 25 percent.

The B21t horizon has hue of 5YR, value of 4, and chroma of 6; or hue of 7.5YR, value of 5, and chroma of 6. It is silty clay loam, clay loam, gravelly silty clay loam, or gravelly clay loam. The content of coarse fragments ranges from 5 to 30 percent.

The B22t horizon has hue of 5YR, value of 4, and chroma of 6; or hue of 2.5YR, value of 4, and chroma of

6 or 8. It is mottled in shades of brown. It is gravelly silty clay loam, gravelly clay loam, very gravelly silty clay, or very gravelly clay loam. The gravel content ranges from 15 to 45 percent.

The B23t, B24t, and B25t horizons have hue of 2.5YR, value of 3 or 4, and chroma of 6; or hue of 5YR, value of 4, and chroma of 6. They are mottled in shades of dark red and brown. They are gravelly silty clay loam, gravelly clay loam, very gravelly silty clay loam, very gravelly clay loam, or very gravelly silty clay. The content of coarse fragments ranges from 20 to 60 percent.

Brockwell series

The Brockwell series consists of deep, well drained, moderately permeable soils that formed in loamy residuum weathered from sandstone. These are gently sloping to moderately steep soils on broad uplands and hillsides. The native vegetation is mixed upland hardwoods and pine. Slope ranges from 3 to 20 percent.

Brockwell soils are geographically associated with Doniphan, Estate, and Portia soils. Doniphan soils are on similar landscapes. They have a clayey control section and contain chert fragments. Estate soils are on adjacent lower side slopes. They have a fine control section and redder subsoils. Portia soils are on similar landscapes. They have a fine-loamy control section and a redder subsoil.

Typical pedon of Brockwell sandy loam, 3 to 8 percent slopes, in a wooded area in the NW1/4NW1/4SE1/4 sec. 33, T. 18 N., R. 11 W. in Baxter County:

A1—0 to 5 inches; dark grayish brown (10YR 4/2) sandy loam; weak medium granular structure; very friable; common medium and fine roots; very strongly acid; clear smooth boundary.

A2—5 to 9 inches; brown (10YR 5/3) sandy loam; weak medium granular structure; very friable; common medium and fine roots; strongly acid; clear smooth boundary.

B1—9 to 13 inches; strong brown (7.5YR 5/6) sandy loam; weak fine subangular blocky structure; friable; common fine and medium roots; strongly acid; clear smooth boundary.

B21t—13 to 28 inches; strong brown (7.5YR 5/6) fine sandy loam; moderate medium subangular blocky structure; firm; many thin patchy clay films on faces of peds; few fine and medium roots; very strongly acid; gradual wavy boundary.

B22t—28 to 44 inches; strong brown (7.5YR 5/6) and pale brown (10YR 6/3) sandy loam; common medium distinct yellowish red (5YR 5/6) mottles; weak coarse subangular blocky structure; firm; common thin patchy clay films on faces of peds; few fine roots; common fine vesicular pores; common pockets and seams of clean sand grains; very strongly acid; gradual smooth boundary.

B23t—44 to 60 inches; strong brown (7.5YR 5/6) and pale brown (10YR 6/3) sandy loam; common

medium distinct yellowish red (5YR 4/6) mottles; weak coarse subangular blocky structure; firm; common thin patchy clay films on faces of peds; common fine vesicular pores; common pockets and seams of clean sand grains; very strongly acid; gradual wavy boundary.

B24t—60 to 72 inches; mottled strong brown (7.5YR 5/6), pale brown (10 YR 6.3), and red (2.5YR 4/6) sandy clay loam; weak coarse subangular blocky structure; firm; many thin patchy clay films on faces of peds and bridging sand grains; few fine vesicular pores; 5 percent by volume fragments of weathered sandstone one-half inch to 2 inches long; very strongly acid.

The solum ranges from 60 to 80 inches in thickness. Reaction ranges from medium acid to very strongly acid throughout, except where the surface layer has been limed. The gravel content ranges from 0 to 35 percent throughout.

The A horizon ranges from 4 to 16 inches in thickness. The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. Texture is sandy loam or gravelly sandy loam. In some pedons, the Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2, 3, or 4. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 2, 3, 4. Texture is fine sandy loam or sandy loam or the gravelly analogs.

In some pedons, the B1 horizon is 3 to 7 inches thick. It has hue of 10YR, value of 4 or 5, and chroma of 4 or 6; or hue of 7.5YR and value of 4 and chroma of 4, or value of 5 and chroma of 4, 6, or 8. It is fine sandy loam, sandy loam, or loam or the gravelly analogs.

The B2t horizon has hue of 10YR, value of 5 or 6, and chroma of 2, 4, or 6, or hue of 7.5YR, value of 5, and chroma of 6. It is fine sandy loam, sandy loam, or sandy clay loam or the gravelly analogs. The lower B2t horizon is commonly mottled in shades of red and brown.

The B3 and C horizons, where present, have colors and textures similar to those of the B2 horizon.

Captina series

The Captina series consists of deep, moderately well drained, slowly permeable soils that formed in loamy residuum weathered from cherty limestone or cherty dolomite. These are nearly level to gently sloping soils on broad uplands and stream terraces. Slope ranges from 1 to 8 percent.

Captina soils are geographically associated with Doniphan, Nixa, Noark, Tonti, and Ventris soils. Doniphan soils are on adjacent side slopes. They have a clayey control section and do not have a fragipan. Nixa soils are on adjacent ridgetops. They are very cherty throughout and have a loamy-skeletal control section. Noark soils are on adjacent hilltops and side slopes. They have a clayey-skeletal control section and do not have a fragipan. Tonti soils are on adjacent similar

positions on the landscape. They are cherty throughout and have a fine-loamy control section. Ventris soils also are on adjacent similar positions on the landscape. They have a very-fine control section and do not have a fragipan.

Typical pedon of Captina silt loam, 1 to 3 percent slopes, in a meadow, near the center of NE1/4NW1/4 sec. 34, T. 20 N., R. 14 W. in Baxter County.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam; weak medium granular structure; friable; many fine roots; 5 percent chert fragments; medium acid; abrupt smooth boundary.

B1—8 to 13 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; common fine roots; many fine and medium tubular pores; 5 percent chert fragments; strongly acid; clear smooth boundary.

B21t—13 to 24 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; thin patchy clay films on faces of peds; common fine roots; many fine and medium tubular pores; 5 percent chert fragments; strongly acid; clear wavy boundary.

Bx1—24 to 32 inches; strong brown (7.5YR 5/6) cherty silty clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium angular blocky structure; firm and brittle; thin continuous clay films on faces of peds and in pores; few fine roots; many fine vesicular pores; 15 percent chert fragments; very strongly acid; gradual smooth boundary.

Bx2—32 to 44 inches; mottled light gray (10 YR 6/1), strong brown (7.5YR 5/8), yellowish red (5 YR 5/6), and yellowish brown (10YR 5/4) very cherty silty clay loam; thick platy structure parting to moderate medium angular blocky structure; firm and brittle; thin continuous clay films on faces of peds and in pores; few fine roots; many fine vesicular pores; 70 percent chert fragments; very strongly acid; diffuse irregular boundary.

B22t—44 to 72 inches; red (2.5YR 4/6) cherty clay; common medium prominent gray (10YR 6/1) and common medium distinct strong brown (7.5YR 5/8) mottles; moderate fine angular blocky structure; firm; thick continuous clay films on faces of peds; few fine pores; 15 percent chert fragments and approximately 2 percent soft weathered siltstone fragments; very strongly acid.

The solum is more than 72 inches thick. Consolidated bedrock is at a depth of more than 72 inches. The fragipan is at a depth of 16 to 30 inches. The A horizon ranges from slightly acid to strongly acid, and the B horizon ranges from strongly acid to extremely acid.

The A horizon ranges from 5 to 10 inches in thickness. The Ap horizon has hue of 10YR and value of 4 and chroma of 2 or 3 or value of 5 and chroma of 3 or 4.

The B1 horizon, where present, has hue of 10YR or 7.5YR, value of 5, and chroma of 4, 6, or 8.

The B21t horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 6 or 8. It is silt loam or silty clay loam. The content of chert above the fragipan ranges from 0 to 5 percent.

The Bx horizon has hue of 10YR, value of 5, and chroma of 4 or 6; it is mottled in shades of gray and yellowish red; or it is mottled with hue of 10YR or 7.5YR, value of 5, and chroma of 6 or 8, and shades of gray and yellowish red. The texture of the fine earth is silty loam or silty clay loam. The upper part of the Bx horizon has 0 to 15 percent chert fragments, and the lower part has 0 to 75 percent chert fragments.

The B22t horizon has hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 4 or 6, or hue of 2.5YR, value of 3, and chroma of 6. It is mottled in shades of gray and brown. The texture of the fine earth is silty clay or clay. The content of chert ranges from 5 to 25 percent.

Clarksville series

The Clarksville series consists of deep, somewhat excessively drained, moderately rapidly permeable, very cherty soils that formed in residuum weathered from very cherty limestone. These are steep soils on side slopes of the Springfield Plateau. The native vegetation is mixed upland hardwoods and pine. Slope ranges from 20 to 50 percent.

Clarksville soils are geographically associated with the Arkana, Elsah, Estate, Moko, Nixa, Noark, and Sidon soils. Arkana soils are on adjacent lower elevations. They are less than 40 inches deep to bedrock and have a very-fine control section. Elsah soils are on adjacent narrow flood plains. They do not have an argillic horizon. Estate soils are on adjacent lower elevations. They contain less chert and have a fine control section. Moko soils are on lower hilltops and side slopes. They are less than 20 inches deep to rock and lack an argillic horizon. Nixa soils are on adjacent higher ridgetops. They have a fragipan. Noark soils are on adjacent similar landscapes. They have a clayey-skeletal control section. Sidon soils are on upland plateaus at higher elevations. They have a fine-loamy control section and a fragipan.

Typical pedon of Clarksville very cherty silt loam, 20 to 50 percent slopes, in a moist wooded area in the NW1/4SW1/4NW1/4 sec. 34, T. 17 N., R. 15 W. in Marion County:

O1—1 inch to 0; partly decomposed hardwood leaves and twigs and pine needles.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) very cherty silt loam; moderate fine granular structure; friable; common fine and medium roots; 50 percent chert fragments; strongly acid; clear smooth boundary.

A2—3 to 12 inches; pale brown (10YR 6/3) very cherty silt loam; weak fine subangular blocky structure;

friable; common medium and coarse roots; 35 percent chert fragments; strongly acid; gradual smooth boundary.

B1—12 to 20 inches; strong brown (7.5YR 5/6) very cherty silt loam with a few irregular streaks of light yellowish brown silt loam; weak fine subangular blocky structure; friable; few fine roots; common fine vesicular pores; 70 percent chert fragments; very strongly acid; gradual smooth boundary.

B21t—20 to 32 inches; yellowish red (5YR 5/6) very cherty silty clay loam with common fine distinct light yellowish brown mottles; moderate fine subangular blocky structure; friable; some peds slightly brittle; common thin patchy clay films on faces of peds; few fine roots; few fine and very fine vesicular pores; 60 percent chert fragments; few black stains; very strongly acid; clear smooth boundary.

B22t—32 to 51 inches; red (2/5YR 4/6) very cherty silty clay; moderate fine angular blocky structure; firm; thick continuous clay films on faces of peds; 75 percent chert fragments; very strongly acid; gradual smooth boundary.

B23t—51 to 72 inches; red (2.5YR 4/6) very cherty silty clay; weak fine angular blocky structure; firm; thick continuous clay films on faces of peds; 80 percent chert fragments; very strongly acid.

The solum ranges from 60 to more than 72 inches in thickness. Reaction is strongly acid or very strongly acid throughout.

The A horizon ranges from 7 to 18 inches thick. The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The A2 horizon has hue of 10YR, value of 4, 5, or 6, and chroma of 2 or 3. The content of chert ranges from 35 to 80 percent in the A horizon.

The B1 horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 4 or 6.

The B21t horizon has hue of 7.5YR or 5YR, value of 5, and chroma of 4 or 6. It is very cherty silt loam or very cherty silty clay loam. In some pedons it is mottled in shades of brown.

The B22t and B23t horizons have hue of 7.5YR, value of 4, and chroma of 4, or value of 5 and chroma of 4 or 6, or they have hue of 5YR or 2/5YR, value of 4 or 5, and chroma of 4 or 6. These horizons are very cherty silt loam, very cherty silty clay loam, or very cherty silt clay. The content of chert ranges from 50 to 90 percent in the B horizon.

Doniphan series

The Doniphan series consists of deep, well drained, moderately permeable soils that formed in clayey residuum weathered from cherty dolomite bedrock. These are gently sloping to moderately steep soils on uplands. The native vegetation is mixed, low grade upland hardwoods. Slope ranges from 3 to 20 percent.

Doniphan soils are geographically associated with Arkana, Britwater, Captina, Gassville, Moko, Nixa, and

Ventris soils. Arkana soils are on adjacent similar landscapes. They have a mollic epipedon and are less than 40 inches to bedrock. Britwater soils are on adjacent lower upland positions. They have more than 35 percent base saturation and a fine-loamy control section. Captina soils are on adjacent gently sloping uplands. They have a fine-silty control section and a fragipan. Gassville soils are on adjacent lower steep side slopes. They have a solum less than 40 inches thick. Moko soils are on adjacent similar landscapes. They are less than 20 inches deep to bedrock and do not have an argillic horizon. Nixa soils are on adjacent similar landscapes. They have a fragipan and a loamy-skeletal control section. Ventris soils are on adjacent gently sloping landscapes. They have a very-fine control section and are less than 40 inches to bedrock.

Typical pedon of Doniphan very cherty silt loam, 3 to 8 percent slopes, in a moist wooded area in the NW1/4NE1/4NE1/4 sec. 22, T. 20 N., R. 13 W.

- A1—0 to 1 inch; dark brown (10YR 3/3) very cherty silt loam; weak fine granular structure; friable; many fine roots; 50 percent chert fragments; medium acid; clear smooth boundary.
- A2—1 to 9 inches; light yellowish brown (10YR 6/4) very cherty silt loam; weak medium subangular blocky structure; friable; common fine and medium roots; common fine pores; 50 percent chert fragments; strongly acid; gradual wavy boundary.
- B1—9 to 17 inches; strong brown (7.5YR 5/6) very cherty silt loam; weak fine subangular blocky structure; friable; common fine and medium roots; common fine pores; 35 percent chert fragments; strongly acid; gradual smooth boundary.
- B21t—17 to 29 inches; yellowish red (5YR 5/8) cherty silty clay; common medium faint red (2.5YR 4/6) and few medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; thin continuous clay films on faces of peds; few medium roots; few fine pores; 25 percent chert fragments; strongly acid; gradual smooth boundary.
- B22t—29 to 56 inches; dark red (2.5YR 3/6) clay; common medium distinct strong brown (7.5YR 5/6) and common medium prominent light yellowish brown (10YR 6/4) mottles; moderate medium angular blocky structure; firm; thick continuous clay films on faces of peds; 5 percent chert fragments; strongly acid; gradual wavy boundary.
- B23t—56 to 78 inches; mottled dark red (2.5YR 3/6), strong brown (7.5YR 5/6), and light gray (10 YR 6/1) clay; strong medium angular blocky structure; firm; thick continuous clay films on faces of peds; 5 percent chert fragments; strongly acid.

The solum ranges from 60 to 100 inches in thickness. The A horizon ranges from slightly acid to strongly acid, and the B horizon is strongly acid or very strongly acid.

The A horizon ranges from 5 to 15 inches in thickness. The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The A2 horizon has hue of 10YR, value of 4, 5, or 6, and chroma of 3 or 4. The Ap horizon, in cultivated areas, has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The content of chert ranges from 35 or 75 percent in the A horizon.

The B1 horizon, if present, has hue of 10YR or 7.5YR, value of 5, and chroma of 4 or 6. Texture is very cherty silt loam or very cherty silty clay loam. The content of chert ranges from 30 to 45 percent.

The B2t horizon has hue of 5YR, value of 4, and chroma of 6, or value of 5 and chroma of 6 or 8, or it has hue of 2.5YR, value of 3, and chroma of 6, or value of 4 or 5 and chroma of 6 or 8. It is mottled in shades of brown and gray.

The B21t horizon is cherty silty clay, cherty clay, silty clay, or clay.

The B22t and B23t horizons are silty clay or clay. Content of chert ranges from 0 to 30 percent in the B21t horizon and 0 to 10 percent in the B22t and B23t horizons.

Elsah series

The Elsah series consists of deep, somewhat excessively drained, moderately rapidly permeable soils that formed in cherty and loamy alluvium. These are level or nearly level soils on narrow flood plains. The native vegetation is bottom land hardwoods. Slope ranges from 0 to 3 percent.

Elsah soils are geographically associated with Arkana, Clarksville, Moko, and Razort soils. Arkana soils are on adjacent steep side slopes. They are less than 45 inches to bedrock and have a very-fine control section. Clarksville soils are on adjacent steep side slopes. They have an argillic horizon and a solum more than 60 inches thick. Moko soils are on adjacent steep side slopes. They are less than 20 inches to bedrock and have a mollic epipedon. Razort soils are on similar landscapes. They have an argillic horizon and contain less chert than the Elsah soils.

Typical pedon of Elsah cherty loam, frequently flooded, in a field in the SW1/4SE1/4NE1/4 sec. 33, T. 20 N., R. 16 W. in Marion County:

- A1—0 to 9 inches, very dark grayish brown (10YR 3/2) cherty loam; moderate medium subangular blocky structure; friable; common fine and medium roots; 25 percent chert fragments; neutral; gradual wavy boundary.
- C1—9 to 34 inches; dark brown (7.5YR 4/4) very cherty loam; massive; friable; common medium and fine roots; 60 percent chert fragments; neutral; clear wavy boundary.
- C2—34 to 42 inches; dark yellowish brown (10YR 4/4) very cherty silt loam; massive; very friable; common fine and medium roots; common fine tubular pores;

35 percent chert fragments; neutral; clear wavy boundary.

C3—42 to 72 inches; dark brown (7.5YR 4/4) and brown (7.5YR 5/4) very cherty loam; massive; few medium roots; 75 percent chert fragments; neutral; abrupt smooth boundary.

R—72 to 74 inches; hard, level-bedded limestone bedrock.

The loamy sediment ranges from 60 to 80 inches thick. Reaction ranges from medium acid to neutral throughout.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2, 3, or 4. The content of chert ranges from 15 to 35 percent. The A horizon is less than 10 inches thick.

The C horizon has hue of 7.5YR, value of 4 or 5, and chroma of 4, or hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Texture is very cherty loam or very cherty silt loam. The content of chert ranges from 35 to 75 percent.

Estate series

The Estate series consists of deep, well drained slowly permeable soils that formed in residuum weathered from interbedded sandstone and limestone. These moderately sloping to steep soils are on rolling uplands and steep side slopes. The native vegetation is upland hardwoods and redcedar. Slope ranges from 8 to 40 percent.

Estate soils are geographically associated with Brockwell, Clarksville, Moko, Noark, Portia, and Ramsey soils. Brockwell soils are on adjacent higher side slopes. They have a coarse-loamy control section and a browner subsoil. Clarksville soils are on side slopes at higher elevations. They are very cherty throughout and have a loamy-skeletal control section. Moko soils are on adjacent similar landscapes. They are less than 20 inches deep to limestone bedrock and do not have an argillic horizon. Noark soils are on side slopes at higher elevations. They are cherty throughout and have a clayey-skeletal control section. Portia soils are on adjacent foot slopes. They have a fine-loamy control section and are more than 60 inches deep to bedrock. Ramsey soils are on adjacent similar landscapes. They lack an argillic horizon and are less than 20 inches deep to bedrock.

Typical pedon of Estate stony sandy loam, from an area of Estate-Portia-Moko association, rolling, in the NE1/4SE1/4NE1/4 sec. 31, T. 18 N., R. 13 W. in Baxter County:

A1—0 to 3 inches; dark grayish brown (10YR 4/2) stony sandy loam; weak medium granular structure; very friable; common fine roots; 15 percent sandstone and limestone fragments one-half inch to 20 inches in diameter; strongly acid; clear smooth boundary.

A2—3 to 8 inches; yellowish brown (10YR 5/4) stony sandy loam; weak medium subangular blocky

structure; very friable; common fine and medium roots; 15 percent sandstone and limestone fragments one-half inch to 20 inches in diameter; few pockets of dark grayish brown sandy loam in old root channels; medium acid; clear smooth boundary.

B1—8 to 13 inches; yellowish red (5YR 4/6) sandy loam; moderate medium subangular blocky structure; friable; common fine and medium roots; common fine pores; 5 percent sandstone gravel; slightly acid; gradual smooth boundary.

B21t—13 to 20 inches; yellowish red (5YR 4/6) clay loam; moderate medium subangular blocky structure; friable; thin continuous clay films on faces of peds and in pores; few fine and medium roots; common fine pores; 10 percent sandstone gravel; few black stains; slightly acid; gradual smooth boundary.

B22t—20 to 36 inches; red (2.5YR 4/6) clay loam; moderate medium subangular blocky structure; firm; thin continuous clay films on faces of peds and in pores; few fine and medium roots; common fine pores; 10 percent sandstone gravel; many black stains; slightly acid; gradual wavy boundary.

B23t—36 to 48 inches; red (2.5YR 4/6) clay with common medium distinct strong brown (7.5YR 5/6) and common medium faint yellowish red (5YR 5/6) mottles; moderate fine angular blocky structure; firm; thin continuous clay films on faces of peds; few fine roots; 10 percent weathered sandstone gravel; many black stains; slightly acid; abrupt wavy boundary.

R—48 to 50 inches; hard, undulating limestone bedrock.

The solum ranges from 40 to 60 inches in thickness. Hard bedrock is at a depth of 40 to 72 inches. The A horizon ranges from strongly acid to neutral, and the B horizon ranges from medium acid to neutral.

The A horizon ranges from 5 to 11 inches in thickness. The A1 has hue of 10YR, value of 4, and chroma of 2, 3, or 4. The A2 horizon has hue of 10YR, value of 4 or 5, and chroma of 2, 3, or 4. The A horizon is stony sandy loam or stony fine sandy loam. The content of coarse fragments ranges from 15 to 30 percent.

The B1 horizon has hue of 7.5YR, value of 4, and chroma of 4, or value of 5 and chroma of 6 or 8, or it has hue of 5YR, value of 4, and chroma of 6. It is sandy loam, fine sandy loam, loam, or sandy clay loam or the gravelly analogs. The content of coarse fragments ranges from 5 to 25 percent.

The B2t horizon has hue of 5YR, value of 4, and chroma of 6, or value of 5 and chroma of 6 or 8, or it has hue of 2.5YR, value of 4, and chroma of 6 or 8, or value of 5 and chroma of 6 or 8. It is clay, clay loam, or sandy clay or the gravelly or cobbly analogs. The content of coarse fragments ranges from 0 to 25 percent.

The Cr horizon, where present, is red, yellow, brown, or gray weathered limestone or sandstone.

The R horizon is hard, undulating limestone or sandstone with a few cracks that are 6 inches or more apart.

Gassville series

The Gassville series consists of moderately deep, well drained, very slowly permeable soils that formed in clayey residuum weathered from dolomite bedrock. These steep soils are on side slopes. The native vegetation is mixed upland hardwoods and redcedar. Slope ranges from 20 to 40 percent.

Gassville soils are geographically associated with Arkana, Doniphan, Moko, Nixa, and Ventris soils. Arkana soils are on adjacent similar landscapes. They are less than 40 inches to bedrock and have more than 35 percent base saturation. Doniphan soils are on adjacent higher uplands. Their solum is more than 60 inches thick. Moko soils are on adjacent similar landscapes. They are less than 20 inches deep to bedrock and do not have an argillic horizon. Nixa soils are on adjacent higher ridgetops. They have a fragipan and a loamy-skeletal control section. Ventris soils are on adjacent higher uplands. They have more than 35 percent base saturation and a browner subsoil.

Typical pedon of Gassville very cherty silt loam, 20 to 40 percent slopes, in a moist wooded area in the NE1/4SE1/4SW1/4 sec. 28, T. 20 N., R. 12 W. in Baxter County:

- A1—0 to 1 inch; dark brown (10YR 3/3) very cherty silt loam; weak fine granular structure; friable; many fine and medium roots; 50 percent chert fragments; medium acid; clear smooth boundary.
- A2—1 to 6 inches; brown (10YR 5/3) very cherty silt loam; weak fine subangular blocky structure; friable; many fine and medium roots; 50 percent chert fragments; strongly acid; clear smooth boundary.
- B1—6 to 10 inches; strong brown (7.5YR 5/6) very cherty silt loam; weak fine subangular blocky structure; friable; common fine and medium roots; few fine pores; 50 percent chert fragments; strongly acid; clear smooth boundary.
- B21t—10 to 19 inches; yellowish red (5YR 5/8) cherty clay; few fine faint strong brown mottles; moderate fine angular blocky structure; firm; common fine and medium roots; thin continuous clay films on faces of peds; 25 percent chert fragments; strongly acid; gradual smooth boundary.
- B22t—19 to 28 inches; yellowish red (5YR 5/8) clay; common medium distinct yellowish brown (10YR 5/8) mottles; moderate medium angular blocky structure; firm; few fine roots; thick continuous clay films on faces of peds; 10 percent chert fragments; strongly acid; gradual smooth boundary.
- B23t—28 to 38 inches; mottled red (2.5YR 4/6) and yellowish brown (10YR 5/4) clay; moderate medium angular blocky structure; firm; thick continuous clay

films on faces of peds; 5 percent chert fragments; strongly acid; abrupt wavy boundary.

Cr—38 to 55 inches; highly fractured soft siltstone bedrock with red (2.5YR 4/6) clay filling cracks and crevices.

R—55 to 57 inches; hard, level-bedded dolomite bedrock with more than 4 inches between cracks.

The solum ranges from 30 to 50 inches thick. Hard rock is at a depth of 40 to 60 inches. The A horizon ranges from strongly acid to slightly acid, and the B horizon is very strongly acid or strongly acid.

The A horizon ranges from 7 to 14 inches in thickness. The A1 horizon has hue of 10YR, value of 3, and chroma of 2 or 3. The A2 horizon has hue of 10YR and value of 4 or 5 and chroma of 3 or value of 6 and chroma of 4. The content of chert ranges from 35 to 70 percent.

The B1 horizon has hue of 7.5YR, value of 5, and chroma of 4 or 6. It is very cherty silt loam or very cherty silty clay loam. The content of chert ranges from 35 to 70 percent.

The B21t horizon has hue of 5YR, value of 5, and chroma of 6 or 8, or hue of 7.5YR, value of 5, and chroma of 6. It is clay, silty clay, cherty clay, or cherty silty clay. The content of chert ranges from 5 to 30 percent.

The B22t horizon has hue of 2.5YR, value of 4, and chroma of 6 or 8, or hue of 5YR and value of 4 and chroma of 6 or value of 5 and chroma of 8. It is mottled in shades of brown. It is clay or cherty clay. The content of chert ranges from 5 to 25 percent.

The B23t horizon has hue of 5YR, value of 5, and chroma of 6 or 8 or hue of 2.5YR, value of 4, and chroma of 6 or 8; or it is mottled in hue of 7.5YR, value of 5, and chroma of 6. It is clay or cherty clay. The content of chert ranges from 5 to 25.

The Cr horizon is weathered, soft siltstone 12 to 24 inches thick.

The R horizon is siltstone or dolomite.

Healing series

The Healing series consists of deep, well drained, moderately permeable soils that formed in thick silty alluvium. These are nearly level soils on low terraces of the White and Norfolk Rivers. These soils are protected from flooding by upstream dams. The native vegetation is bottom land hardwoods and bamboo cane. Slope ranges from 1 to 3 percent.

Healing soils are geographically associated with Arkana, Britwater, Moko, Razort, and Wideman soils. Arkana soils are on adjacent steep side slopes. They have a very-fine control section and are less than 40 inches deep to bedrock. Britwater soils are on adjacent higher terraces. They have a fine-loamy control section and lack a mollic epipedon. Moko soils are on adjacent steep side slopes. They have a loamy-skeletal control

section and are less than 20 inches deep to bedrock. Razort soils are on similar landscapes. They have a fine-loamy control section and lack a mollic epipedon. Wideman soils are on adjacent natural levees along the river. They have a light-colored surface layer and a sandy control section.

Typical pedon of Healing silt loam, 1 to 3 percent slopes, in a meadow in the NW1/4NE1/4SE1/4 sec. 1, T. 18 N., R. 13 W. in Baxter County:

- Ap—0 to 6 inches; dark brown (10YR 3/3) silt loam; weak medium granular structure; friable; many fine roots; common fine and medium pores; slightly acid; abrupt smooth boundary.
- A12—6 to 13 inches; dark brown (10YR 3/3) silt loam; weak fine subangular blocky structure; friable; many fine and medium roots; common fine pores; slightly acid; gradual smooth boundary.
- B21t—13 to 26 inches; brown (7.5YR 4/4) silt loam; moderate fine and medium subangular blocky structure; friable; common thin patchy clay films on faces of peds; common fine and medium roots; common fine and medium pores; slightly acid; gradual smooth boundary.
- B22t—26 to 48 inches; reddish brown (5YR 4/4) silt loam; moderate fine and medium subangular blocky structure; friable; common thin patchy clay films on faces of peds; common fine and medium roots; common fine and medium pores; slightly acid; gradual smooth boundary.
- B23t—48 to 68 inches; reddish brown (5YR 4/4) silt loam; with few fine faint pale brown mottles; moderate fine and medium subangular blocky structure; friable; common thin patchy clay films on faces of peds; few medium roots; common fine and medium pores; slightly acid; gradual smooth boundary.
- B24t—68 to 80 inches; brown (7.5YR 4/4) silt loam with few fine faint yellowish brown mottles; weak fine subangular blocky structure; very friable; few thin patchy clay films on faces of peds; few fine pores; slightly acid.

The solum ranges from 60 to 72 inches in thickness. Reaction is medium acid or slightly acid throughout.

The A horizon ranges from 10 to 20 inches in thickness. It has hue of 10YR, value of 3, and chroma of 2 or 3, or hue of 7.5YR, value of 3, and chroma of 2. The content of gravel ranges from 0 to 5 percent.

The B21t horizon has hue of 10YR, value of 3 or 4, and chroma of 3, or hue of 7.5YR, value of 4, and chroma of 4 or value of 3 and chroma of 2, or hue of 5YR, value of 4, and chroma of 4. It is silt loam or silty clay loam. The content of gravel ranges from 0 to 5 percent.

The B22t and B23t horizons have hue of 10YR, value of 4, and chroma of 3, or hue of 7.5YR or 5YR, value of 4, and chroma of 4. In some pedons they are mottled in

shades of brown. The B22t horizon is silt loam or silty clay loam, and the B23t horizon is silt loam, silty clay loam, gravelly silt loam, or gravelly silty clay loam. The content of gravel ranges from 0 to 5 percent in the B22t horizon and 0 to 25 percent in the B23t horizon.

The B24t horizon has hue of 10YR, value of 4, and chroma of 3, or hue of 7.5YR or 5YR, value of 4, and chroma of 4. Texture is silt loam, silty clay loam, gravelly silt loam, or gravelly silty clay loam. The content of gravel ranges from 0 to 25 percent.

Moko series

The Moko series consists of shallow, well drained, moderately permeable soils that formed in residuum weathered from dolomite or limestone. These are gently sloping to steep soils on mountainsides and ridges. Slope ranges from 3 to 40 percent.

Moko soils are geographically associated with Arkana, Clarksville, Doniphan, Estate, Gassville, and Portia soils. Arkana soils are on adjacent similar landscapes. They are more than 20 inches deep to bedrock and have an argillic horizon. Clarksville soils are on steep hillsides at higher elevations. They are more than 20 inches deep to bedrock and have an argillic horizon. Doniphan soils are on similar landscapes. They are more than 20 inches deep to bedrock and have an argillic horizon. Estate soils are on adjacent similar landscapes. They are more than 20 inches deep to bedrock and have an argillic horizon. Gassville soils are on adjacent similar landscapes. They are more than 20 inches deep to bedrock and have an argillic horizon. Portia soils are on adjacent lower foot slopes. They are more than 20 inches deep to bedrock and have an argillic horizon.

Typical pedon of Moko very stony silt loam from an area of Arkana-Moko complex, 3 to 8 percent slopes, in a wooded area in the SE1/4SE1/4NE1/4 sec. 20, T. 20 N., R. 12 W. in Baxter County:

- O1—1 inch to 0; hardwood leaves and cedar needles.
- A11—0 to 7 inches; very dark brown (10YR 2/2) very stony silt loam; moderate medium granular structure; friable; many fine and medium roots; 50 percent by volume dolomite cobbles and chert fragments; neutral; clear smooth boundary.
- A12—7 to 12 inches; very dark grayish brown (10YR 3/2) very stony silt loam; weak medium subangular blocky structure; friable; common fine and medium subangular blocky structure; friable; common fine and medium roots; 70 percent chert and flaggy dolomite fragments; mildly alkaline; abrupt smooth boundary.
- R—12 to 14 inches; level-bedded, hard dolomite bedrock.

The solum is 6 to 20 inches thick. Bedrock is at a depth of 6 to 20 inches. Reaction is neutral or mildly alkaline throughout. The content of chert fragments

ranges from 10 to 25 percent by volume. The content of fragments of dolomite or limestone that are more than 3 inches thick ranges from 25 to 60 percent by volume.

The A horizon ranges from 6 to 20 inches in thickness. The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is very stony silt loam, very stony loam, or very stony silty clay loam.

The R horizon is hard, level-bedded limestone or dolomite bedrock.

Mountainburg series

The Mountainburg series consists of shallow, well drained, moderately rapidly permeable soils that formed in loamy residuum weathered from acid sandstone. These gently sloping to steep soils are on mountaintops and the adjacent steep side slopes. The native vegetation is upland hardwoods. Slope ranges from 3 to 40 percent.

Mountainburg soils are geographically associated with Clarksville, Nixa, Noark, and Sidon soils. Clarksville soils are on adjacent side slopes. They are at lower elevations, are cherty throughout, and are deeper than 20 inches to bedrock. Nixa soils are on ridgetops. They are at lower elevations. They are cherty throughout, are deeper than 20 inches to bedrock, and have a fragipan. Noark soils are on side slopes. They are at lower elevations. They are cherty throughout, are deeper than 20 inches to bedrock, and have a clayey-skeletal control section. Sidon soils are on adjacent similar landscapes. They have a fragipan and are more than 20 inches deep to bedrock.

Typical pedon of Mountainburg very stony sandy loam, 3 to 15 percent slopes, in a wooded area in the NE1/4SE1/4NW1/4 sec. 27, T. 16 N., R. 13 W. in Baxter County:

- A1—0 to 1 inch; dark grayish brown (10YR 4/2) very stony sandy loam; moderate medium granular structure; friable; many fine and medium roots; 35 percent sandstone fragments, one-fourth inch to 2 feet in diameter; medium acid; clear smooth boundary.
- A2—1 to 6 inches; brown (10YR 4/3) very stony sandy loam; weak medium subangular blocky structure; friable; common fine and medium roots; 35 percent sandstone fragments, one-half inch to 12 inches in diameter; strongly acid; gradual wavy boundary.
- B2t—6 to 18 inches; strong brown (7.5YR 5/6) very gravelly sandy clay loam; moderate medium subangular blocky structure; friable; common thin patchy clay films on faces of peds; common fine and medium roots; few fine black concretions; 35 percent sandstone fragments, one-half inch to 3 inches in diameter, and 5 percent sandstone fragments, 3 to 12 inches in diameter; very strongly acid; abrupt smooth boundary.
- R—18 to 20 inches; hard, horizontally bedded sandstone bedrock.

The solum ranges from 12 to 20 inches in thickness. Bedrock is at a depth of 12 to 20 inches. The A horizon is medium acid or strongly acid, and the B horizon is strongly acid or very strongly acid.

The A horizon ranges from 4 to 9 inches in thickness. The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. In cultivated areas, the Ap horizon has hue of 10YR and value of 4 or 5 and chroma of 3 or value of 4 and chroma of 2. The A2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The A horizon is sandy loam, fine sandy loam, or loam and the gravelly, stony, or very stony analogs. The content of coarse fragments in the A horizon ranges from 15 to 60 percent.

The B2t horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 6 or hue of 5YR, value of 4, and chroma of 8. The B horizon is very gravelly sandy clay loam or very gravelly loam. The content of coarse fragments in the B horizon ranges from 35 to 60 percent.

The R horizon is hard, level to undulating, acid sandstone bedrock.

Nixa series

The Nixa series consists of deep, moderately well drained, very slowly permeable very cherty soils that formed in residuum weathered from cherty limestone or cherty dolomite. These gently sloping to moderately steep soils are on ridgetops and uplands. The native vegetation is upland hardwoods. Slope ranges from 3 to 20 percent.

Nixa soils are geographically associated with Captina, Clarksville, Doniphan, Gassville, Mountainburg, Noark, and Sidon soils. Captina soils are on adjacent broad upland flats. They have very little chert above the fragipan and have a fine-silty control section. Clarksville soils are on adjacent lower hillsides. They do not have a fragipan. Doniphan soils are on adjacent similar landscapes. They do not have a fragipan but have a clayey control section. Gassville soils are on adjacent lower side slopes. They do not have a fragipan and have a clayey control section. Mountainburg soils are on mountaintops at higher elevations. They are less than 20 inches deep to bedrock and do not have a fragipan. Sidon soils are on upland plateaus at lower elevations. They have a fine-loamy control section. Noark soils are on similar landscapes. They do not have a fragipan and have a clayey-skeletal control section.

Typical pedon of Nixa very cherty silt loam, 8 to 12 percent slopes, in a wooded area in the NW1/4SE1/4SW1/4 sec. 21, T. 19 N., R. 16 W. in Marion County:

- A1—0 to 2 inches; very dark grayish brown (10YR 3/2) very cherty silt loam; weak fine granular structure; friable; common fine roots; few fine pores; 40 percent chert fragments, one-fourth inch to 4 inches in diameter; strongly acid; clear smooth boundary.

A2—2 to 11 inches; brown (10YR 5/3) very cherty silt loam; moderate fine subangular blocky structure; friable; common fine and medium roots; common fine pores; 40 percent chert fragments, one-fourth inch to 4 inches in diameter; strongly acid; gradual smooth boundary.

B1—11 to 22 inches; light yellowish brown (10YR 6/4) very cherty silt loam; weak to moderate fine subangular blocky structure; friable; common fine and medium roots; few fine pores; 60 percent chert fragments, 1 inch to 4 inches in diameter; very strongly acid; gradual wavy boundary.

Bx—22 to 44 inches; yellowish brown (10YR 5/4) very cherty silt loam; common medium distinct strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2) and few fine yellowish red (5YR 5/6) mottles; weak fine subangular structure; firm and brittle; 70 percent chert fragments, 1 inch to 6 inches in diameter; common fine pores; common thin patchy clay films on faces of peds and on chert fragments; few fine roots in gray streaks; few fine concretions; few black stains on chert faces; very strongly acid; gradual wavy boundary.

B2t—44 to 72 inches; mottled yellowish red (5YR 4/6), strong brown (7.5YR 5/6), and light brownish gray (10YR 6/2) very cherty silty clay loam; weak medium angular blocky structure to massive; firm; slightly brittle; 80 percent chert fragments up to 6 inches in diameter; few fine pores; thin continuous clay films on faces of peds; very strongly acid.

The fragipan is at a depth of 14 to 24 inches. Consolidated bedrock is at a depth of over 60 inches. Reaction is strongly acid or very strongly acid throughout, except where the surface horizon has been limed.

The A horizon ranges from 6 to 13 inches in thickness. In cultivated areas the Ap horizon has hue of 10YR and value of 4 or 5 and chroma of 3 or value of 5 and chroma of 4. The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 2. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. The content of chert in the A horizon ranges from 25 to 70 percent.

The B1 horizon has hue of 10YR, value of 5 or 6, and chroma of 4 or 6. It is very cherty silt loam or very cherty silty clay loam. The content of chert ranges from 35 to 75 percent.

In some pedons an A'2 horizon is present. It has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. It is very cherty silt loam.

The Bx horizon has hue of 10YR, value of 5, and chroma of 4 or 6 or hue of 7.5YR, value of 5, and chroma of 4 or 6. It is mottled in shades of brown, gray, or red. It is very cherty silt loam or very cherty silty clay loam. The content of chert in the Bx horizon ranges from 40 to 75 percent.

The B2t horizon has hue of 2.5YR, value of 3, and chroma of 6 or value of 4 or 5 and chroma of 4, 6, or 8;

or it has hue of 5YR, value of 4, and chroma of 4 or 6 or value of 5 and chroma of 4, 6, or 8. It is mottled in shades of red, brown, and gray. It is very cherty silty clay or very cherty silty clay loam. The content of chert ranges from 50 to 85 percent.

Noark series

The Noark series consists of deep, well drained, moderately permeable soils that formed in residuum weathered from cherty limestone bedrock. These gently sloping to steep soils are on side slopes and uplands. The native vegetation is upland hardwoods and pine. Slope ranges from 3 to 40 percent.

Noark soils are geographically associated with Captina, Clarksville, Estate, Nixa, Portia, Sidon, and Tonti soils. Captina soils are on adjacent gently sloping uplands. They have a fine-silty control section and a fragipan. Clarksville soils are on adjacent steep side slopes. They have a loamy-skeletal control section. Estate soils are on hillsides at lower elevations. They have a clayey control section. Nixa soils are on adjacent ridges and uplands. They have a loamy-skeletal control section and a fragipan. Portia soils are on foot slopes at lower elevations. They have a fine-loamy control section and contain no chert fragments. Sidon soils are on upland plateaus at higher elevations. They have a fragipan and a fine-loamy control section. Tonti soils are on adjacent gently sloping uplands. They have a fine-loamy control section and a fragipan.

Typical pedon of Noark very cherty silt loam, 8 to 20 percent slopes, in a wooded area in the NW1/4NW1/4NW1/4 sec. 12, T. 16 N., R. 13 W. in Baxter County:

A1—0 to 4 inches; dark grayish brown (10YR 4/2) very cherty silt loam; moderate fine granular structure; friable; 60 percent angular chert fragments; many fine roots; medium acid; clear smooth boundary.

A2—4 to 18 inches; pale brown (10YR 6/3) very cherty silt loam; weak medium subangular blocky structure; friable; 50 percent angular chert fragments; common fine and medium roots; strongly acid; gradual smooth boundary.

B1—18 to 24 inches; yellowish red (5YR 4/6) very cherty silt loam; moderate medium subangular blocky structure; friable; 50 percent angular chert fragments; few thin patchy clay films on faces of peds; common fine roots; very strongly acid; gradual smooth boundary.

B2t—24 to 40 inches; red (2.5YR 4/8) very cherty silty clay; moderate fine angular blocky structure; firm; thin continuous clay films on faces of peds; 50 percent angular chert fragments; common fine and medium roots; very strongly acid; gradual smooth boundary.

B22t—40 to 72 inches; red (2.5YR 4/8) very cherty silty clay; moderate fine angular blocky structure; firm;

thick continuous clay films on faces of peds; few fine roots; 80 percent soft chert fragments; small pockets of pink (7.5YR 7/4) silt loam from decomposed chert fragments; very strongly acid.

The solum ranges from 60 to more than 80 inches in thickness. The A horizon ranges from strongly acid to slightly acid, and the B horizon is very strongly acid or strongly acid.

The A horizon ranges from 8 to 18 inches in thickness. The A1 horizon has hue of 10YR and value of 4 and chroma of 2 or 3 or value of 3 and chroma of 3. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 3. The Ap horizon, where present, has hue of 10YR, value of 3 or 4, and chroma of 3 or 4. The content of chert in the A horizon ranges from 35 to 70 inches.

The B1 horizon has hue of 5YR, value of 4, and chroma of 6 or hue of 7.5YR or 10YR, value of 5, and chroma of 6. It is very cherty silt loam or very cherty silty clay loam.

The B2t horizon has hue of 2.5YR and value of 4 and chroma of 6 or 8, value of 5 and chroma of 6, or value of 3 and chroma of 6; or hue of 5YR, value of 4, and chroma of 6 to 8. It is very cherty clay or very cherty silty clay. Some pedons are mottled in shades of brown. The content of chert ranges from 35 to 70 percent in the B21t horizon and from 50 to 80 percent in the B22t horizon.

Portia series

The Portia series consists of deep, well drained, moderately slowly permeable soils that formed in loamy residuum or colluvium weathered from interbedded sandstone and limestone. These gently sloping to steep soils are on foot slopes and uplands. The native vegetation is mixed upland hardwoods and pine. Slope ranges from 3 to 30 percent.

Portia soils are geographically associated with Brockwell, Estate, Moko, Noark, and Ramsey soils. Brockwell soils are on a similar landscape. They have a coarse-loamy control section and a browner subsoil. Estate soils are on adjacent hillsides. They are less than 60 inches deep to bedrock and have a clayey control section. Moko soils are on adjacent hillsides. They are less than 20 inches deep to bedrock and do not have an argillic horizon. Noark soils are on adjacent hillsides at higher elevations. They are cherty throughout and have a clayey-skeletal control section. Ramsey soils are on lower uplands. They do not have an argillic horizon and are less than 20 inches deep to bedrock.

Typical pedon of Portia fine sandy loam, 8 to 12 percent slopes, in a idle field in the SE1/4SE1/4SE1/4 sec. 26, T. 18 N., R. 17 W. in Marion County:

Ap—0 to 4 inches; brown (10YR 4/3) fine sandy loam; weak medium granular and subangular blocky structure; friable; many fine roots; common fine

pores; 1 percent dark-coated sandstone gravel; slightly acid; clear smooth boundary.

B1—4 to 10 inches; dark brown (7.5YR 4/4) fine sandy loam; weak medium subangular blocky structure; friable; common fine roots; common fine pores; 2 percent dark-coated sandstone gravel; slightly acid; clean smooth boundary.

B21t—10 to 20 inches; yellowish red (5YR 4/6) sandy clay loam; moderate medium subangular blocky structure; friable; common thin patchy clay films on faces of peds; common fine and medium roots; common fine pores; common patchy dark coatings on faces of peds; 2 percent dark-coated sandstone gravel; few medium black concretions; medium acid; gradual smooth boundary.

B22t—20 to 30 inches; red (2.5YR 4/6) sandy clay loam; moderate medium subangular blocky structure; friable; thin continuous clay films on faces of peds; common medium roots; common fine pores; common patchy dark coatings on faces of peds; few medium black concretions; 2 percent fine dark-coated sandstone gravel; medium acid; gradual smooth boundary.

B23t—30 to 58 inches; red (2.5YR 4/6) sandy clay loam; weak medium subangular blocky structure; firm; some peds slightly brittle; common thin patchy clay films on faces of peds; 3 percent soft- and dark-coated sandstone gravel; many patchy dark coatings on ped faces; few medium black concretions; medium acid; gradual smooth boundary.

B24t—58 to 72 inches; red (2.5YR 4/6) sandy clay loam; weak medium subangular blocky structure; friable; common thin patchy clay films on faces of peds; 5 percent soft- and dark-coated sandstone gravel; common patchy dark coatings on ped faces; several small pockets of clean sand grains; medium acid.

The solum ranges from 60 to more than 80 inches in thickness. The A and B1 horizons range from slightly acid to strongly acid, and the B2t horizon is medium acid to very strongly acid.

The A horizon ranges from 3 to 16 inches in thickness. The Ap horizon has hue of 10YR, value of 4, and chroma of 3 or 4. The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. In some pedons an A2 horizon is present. It has hue of 10YR, value of 5, and chroma of 3 or 4.

The B1 horizon has hue of 7.5YR and value of 4 and chroma of 4 or value of 5 and chroma of 4, 6, or 8. It is fine sandy loam or sandy loam.

The B21t horizon has hue of 5YR and value of 4 and chroma of 6 or value of 5 and chroma of 6 or 8; or it has hue of 2.5YR, value of 4 or 5, and chroma of 6 to 8. It is sandy clay loam or loam.

The B22t horizon has hue of 5YR and value of 4 and chroma of 6 or value of 5 and chroma of 6 or 8; or it has hue of 2.5YR, value of 4, and chroma of 6 or 8. It is sandy clay loam, clay loam, or silty clay loam.

The B23t and B24t horizons have hue of 5YR, value of 4, and chroma of 6 or 8, or it has hue of 2.5YR and value of 3 and chroma of 6 or value of 4 and chroma of 6 or 8. It is mottled in shades of brown. It is sandy clay loam, clay loam, or sandy clay.

Ramsey series

The Ramsey series consists of shallow, somewhat excessively drained, rapidly permeable soils that formed in residuum from acid sandstone. These gently sloping to moderately steep soils are on uplands. Slope ranges from 8 to 20 percent.

Ramsey soils are geographically associated with Estate and Portia soils and Udorthents. Estate soils are on adjacent similar landscapes. They have an argillic horizon and are deeper than 20 inches to bedrock. Portia soils are on foot slopes at slightly higher elevations. They have an argillic horizon and are deeper than 20 inches to bedrock. Udorthents are on similar landscapes. They do not have a B horizon.

Typical pedon of Ramsey stony sandy loam in a wooded area of Udorthents-Ramsey-Rock outcrop complex, 3 to 20 percent slopes, in the SW1/4NE1/4NE1/4 sec. 17, T. 17 N., R. 12 W. in Baxter County:

- A1—0 to 1 inch; dark brown (10YR 3/3) stony sandy loam; weak fine granular structure; friable; many fine and medium roots; common fine pores; 15 percent sandstone fragments; strongly acid; abrupt smooth boundary.
- A2—1 to 7 inches; brown (10YR 4/3) stony sandy loam; weak medium subangular blocky structure; friable; common fine and medium roots; common fine and medium pores; 20 percent sandstone fragments; very strongly acid; gradual smooth boundary.
- B—7 to 13 inches; yellowish brown (10YR 5/4) stony sandy loam; moderate medium subangular blocky structure; common medium roots; common fine pores; 20 percent sandstone fragments; very strongly acid; abrupt smooth boundary.
- R—13 to 15 inches; hard, level-bedded acid sandstone.

The solum ranges from 10 to 20 inches in thickness. Reaction is strongly acid or very strongly acid throughout.

The A horizon ranges from 3 to 7 inches in thickness. The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The A2 horizon has hue of 10YR and value of 4 and chroma of 2 or 3 or value of 5 and chroma of 3 or 4. The A horizon is stony sandy loam or stony fine sandy loam. The content of coarse fragments ranges from 15 to 35 percent.

The B horizon has hue of 10YR and value of 4 and chroma of 4 or value of 5 and chroma of 4 or 6, or it has hue of 7.5YR, value of 5, and chroma of 6. It is stony sandy loam. The content of coarse fragments ranges from 15 to 35 percent.

The R horizon is hard, acid sandstone bedrock.

Razort series

The Razort series consists of deep, well drained, moderately permeable soils that formed in loamy alluvium. These level to nearly level soils are on flood plains. The native vegetation is bottom land hardwoods and bamboo cane. Slopes range from 0 to 3 percent.

Razort soils are geographically associated with Britwater, Elsay, Healing, and Wideman soils. Britwater soils are on adjacent higher terraces. They do not have mollic colors in the A horizon and have a redder subsoil. Elsay soils are on similar landscapes, do not have an argillic horizon, and have a loamy-skeletal control section. Healing soils are on similar landscapes. They have a fine-silty control section and a mollic epipedon. Wideman soils are on adjacent natural levees. They have a sandy control section.

Typical pedon of Razort silt loam, frequently flooded, in a field in the SW1/4NE1/4NE1/4 sec. 15, T. 20 N., R. 13 W. in Baxter County:

- Ap—0 to 10 inches; dark brown (10YR 3/3) silt loam; weak medium subangular blocky structure; friable; many fine roots; common fine pores; 10 percent rounded chert gravel; neutral; clear smooth boundary.
- B21t—10 to 33 inches; dark brown (10YR 3/3) loam; weak coarse subangular blocky structure; very friable; few thin patchy clay films on faces of peds; common fine roots; few fine pores; 5 percent fine chert gravel; many root channels filled with very dark brown (10YR 2/2) silt loam; slightly acid; gradual smooth boundary.
- B22t—33 to 41 inches; dark brown (7.5YR 4/4) gravelly loam; weak medium subangular blocky structure; very friable; few thin patchy clay films on faces of peds; 15 percent fine chert gravel; slightly acid; gradual smooth boundary.
- B23t—41 to 58 inches; dark brown (10YR 3/3) silty clay loam; weak coarse subangular blocky structure; friable; few thin patchy clay films on faces of peds; 5 percent chert gravel; slightly acid; clear smooth boundary.
- IIC—58 to 85 inches; dark yellowish brown (10YR 4/4) very gravelly loamy sand; single grain; 60 percent chert gravel; slightly acid.

The solum ranges from 40 to 60 inches in thickness. The A horizon is neutral or slightly acid, and the B horizon is slightly acid or medium acid.

The A horizon ranges from 6 to 10 inches in thickness. The A horizon has hue of 10YR, value of 3, and chroma of 3 or 4, or hue of 7.5YR, value of 3, and chroma of 2.

The B1 horizon, where present, has hue of 10YR and value of 3 and chroma of 3 or 4 or value of 4 and chroma of 3. It is loam or silt loam or the gravelly analogs.

The B2t horizon has hue of 10YR and value of 3 and chroma of 3 or value of 4 and chroma of 3 or 4, or has hue of 7.5YR, value of 4, and chroma of 4. It is silt loam, silty clay loam, loam, or clay loam or the gravelly analogs. The content of gravel ranges from 0 to 25 percent.

The underlying IIC horizon is stratified silty, sandy, and gravelly material.

Sidon series

The Sidon series consists of deep, moderately well drained, slowly permeable soils that formed in loamy material weathered from interbedded sandstone and siltstone. These are gently sloping soils on undulating plateaus. The native vegetation is upland hardwoods. Slope ranges from 3 to 8 percent.

Sidon soils are geographically associated with Clarksville, Mountainburg, Nixa, and Noark soils. Clarksville soils are on adjacent side slopes at lower elevations. They lack a fragipan and have a loamy-skeletal control section. Mountainburg soils are on adjacent similar landscapes. They are less than 20 inches to bedrock and do not have a fragipan. Nixa soils are on adjacent ridgetops at lower elevations. They are cherty throughout and have a loamy-skeletal control section. Noark soils are on adjacent ridges and side slopes at lower elevations. They lack a fragipan and have a clayey-skeletal control section.

Typical pedon of Sidon silt loam, 3 to 8 percent slopes, in a pasture in the NW1/4SE1/4SE1/4 sec. 26, T. 16 N., R. 13 W. in Baxter County:

Ap—0 to 7 inches; yellowish brown (10YR 5/4) silt loam; moderate medium granular structure; friable; many fine roots; medium acid; clear smooth boundary.

B2t—7 to 21 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; common thin patchy clay films on faces of peds and in pores; common fine and medium roots; 2 percent sandstone gravel; strongly acid; abrupt smooth boundary.

Bx1—21 to 33 inches; yellowish brown (10YR 5/6) silt loam; many medium prominent light brownish gray (10YR 6/2) mottles; weak thick platy parting to weak medium angular blocky structure; firm and brittle; thin continuous clay films on faces of peds and on pore walls; many fine and medium tubular and vesicular pores; few fine roots between prisms; 2 percent sandstone gravel; strongly acid; clear smooth boundary.

Bx2—33 to 44 inches; mottled gray (10YR 6/1), strong brown (7.5YR 5/6), and red (2.5YR 4/6) gravelly clay loam; moderate medium subangular blocky structure; firm and brittle; thin continuous clay films on faces of peds and on pore walls; few fine roots between prisms; common fine and medium tubular and vesicular pores; 30 percent soft sandstone

fragments; very strongly acid; gradual smooth boundary.

B3t—44 to 58 inches; mottled gray (10YR 6/1), red (2.5YR 4/6), and strong brown (7.5YR 5/6) very gravelly clay loam; weak medium subangular blocky structure; firm, some peds slightly brittle; thin continuous clay films on faces of peds; few very fine tubular pores; 40 percent soft sandstone fragments; very strongly acid; abrupt smooth boundary.

R—58 to 60 inches; hard, level-bedded, acid sandstone bedrock.

The fragipan ranges in depth from 20 to 36 inches. The solum ranges from 40 to more than 72 inches in thickness. Bedrock is at a depth of 40 to more than 72 inches. Reaction is strongly acid or very strongly acid throughout, except where the surface layer has been limed.

The Ap horizon ranges from 4 to 7 inches thick. It has hue of 10YR, value of 4 or 5, and chroma of 3 or 4.

The B2t horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 6 or 8. It is loam or silty clay loam.

The Bx horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 6 or 8. It is mottled in shades of gray, brown, and red. It is silty clay loam, silt loam, or clay loam or the gravelly analogs. The content of coarse fragments ranges from 0 to 35 percent.

The B3t horizon has colors similar to those of the Bx horizon. It is loam or clay loam or the gravelly or very gravelly analogs. The content of coarse fragments ranges from 0 to 45 percent.

In some pedons, there is a Cr horizon of rippable, soft, highly weathered sandstone. It ranges from 1 to 4 inches thick. Sandy soil material mottled in shades of red, brown, and gray fills the cracks and crevices between the rock fragments.

The R horizon is hard, level-bedded acid sandstone.

Tonti series

The Tonti series consists of deep, moderately well drained, slowly permeable soils that formed in material weathered from cherty limestone or cherty dolomite. These are gently sloping soils on broad uplands. Slope ranges from 3 to 8 percent.

Tonti soils are geographically associated with Captina, Doniphan, Nixa, and Noark soils. Captina soils are on adjacent similar landscapes. They do not have chert in the surface layer and have a fine-silty control section. Doniphan soils are on adjacent similar landscapes. They do not have a fragipan but have a clayey control section. Nixa soils are on adjacent higher ridges. They are cherty throughout and have a loamy-skeletal control section. Noark soils are on adjacent similar landscapes. They are cherty throughout, do not have a fragipan, and have a clayey-skeletal control section.

Typical pedon of Tonti cherty silt loam, 3 to 8 percent slopes, in a meadow in the NW1/4NE1/4NW1/4 sec. 3, T. 19 N., R. 13 W. in Baxter County:

- Ap—0 to 7 inches, brown (10YR 4/3) cherty silt loam; weak medium subangular blocky structure; friable; common fine roots; 15 percent angular chert fragments; few fine black concretions; slightly acid; clear smooth boundary.
- B2t—7 to 19 inches; strong brown (7.5YR 5/6) cherty silt loam; moderate medium subangular blocky structure; friable; many thin patchy clay films on faces of peds; few fine roots; 25 percent chert fragments; strongly acid; gradual smooth boundary.
- Bx—19 to 32 inches; strong brown (7.5YR 5/6) very cherty silt loam; common coarse distinct light yellowish brown (10YR 6/4) and few fine faint reddish brown mottles; moderate fine and medium subangular blocky structure; firm and brittle; 60 percent chert fragments; few fine black stains; strongly acid; gradual smooth boundary.
- B3t—32 to 72 inches; red (2.5YR 4/6) clay, common medium distinct strong brown (7.5YR 5/6) mottles; moderate fine angular blocky structure; firm; thick continuous clay films on faces of peds; 10 percent chert fragments; strongly acid.

The fragipan is at a depth of 15 to 24 inches. The solum is 60 to more than 72 inches in thickness. Consolidated bedrock is at a depth of more than 72 inches. Reaction is strongly acid or very strongly acid throughout, except where the surface layer has been limed.

The A horizon ranges from 5 to 9 inches in thickness. The A horizon has hue of 10YR and value of 4 or 5 and chroma of 3 or value of 4 and chroma of 2. The content of chert ranges from 15 to 20 percent.

The B2t horizon has hue of 10YR, value of 5, and chroma of 4 or 6, or it has hue of 7.5YR, value of 5, and chroma of 6. It is cherty silt loam or cherty silty clay loam. The content of chert ranges from 15 to 25 percent.

The Bx horizon has hue of 10YR, value of 5, and chroma of 4 or 6, or has hue of 7.5YR, value of 5, and chroma of 6. It is commonly mottled in shades of brown, red, and gray. It is silty clay loam or silt loam. The content of chert ranges from 45 to 75 percent.

The B3t horizon has hue of 5YR, value of 4 or 5, and chroma of 4 or 6 or has hue of 2.5YR, value of 4, and chroma of 4 or 6. It is mottled in brown and gray. It is cherty silty clay, cherty clay, silty clay, or clay. The content of chert ranges from 10 to 25 percent.

Ventris series

The Ventris series consists of moderately deep, moderately well drained, very slowly permeable soils that formed in clayey residuum weathered from cherty dolomite bedrock. These are gently sloping soils on uplands. The native vegetation is upland hardwoods and redcedar. Slope ranges from 3 to 8 percent.

Ventris soils are geographically associated with Arkana, Captina, Doniphan, Gassville, and Moko soils.

Arkana soils are on adjacent similar landscapes and steep side slopes. They do not have an abrupt textural change from the A horizon to the B horizon and have a redder subsoil. Captina soils are on adjacent similar landscapes. They have a fine-silty control section and a fragipan. Doniphan soils are on adjacent similar landscapes. They are more than 40 inches deep to bedrock and have a clayey control section. Gassville soils are on adjacent steep side slopes. They have less than 35 percent base saturation and a redder subsoil. Moko soils are on adjacent similar landscapes and steep side slopes. They are less than 20 inches deep to bedrock and do not have an argillic horizon.

Typical pedon of Ventris cherty silt loam, 3 to 8 percent slopes, in a wooded area in the SE1/4SW1/4NW1/4 sec. 2, T. 19 N., R. 13 W. in Baxter County:

- O1—1 inch to 0; oak leaves and twigs.
- A1—0 to 1 inch; very dark grayish brown (10YR 3/2) cherty silt loam; moderate fine granular structure; friable; common fine and medium roots; 15 percent angular chert fragments; slightly acid; abrupt smooth boundary.
- A2—1 to 5 inches; brown (10YR 5/3) cherty silt loam; weak fine subangular blocky structure; friable; common fine and medium roots; 15 percent angular chert fragments; medium acid; abrupt smooth boundary.
- B21t—5 to 17 inches; yellowish brown (10YR 5/6) clay; common medium distinct light brownish gray (10YR 6/2) and few fine distinct yellowish red mottles; weak fine angular blocky structure; firm; few medium roots; 2 percent angular cherty fragments; thick continuous clay films on faces of peds; medium acid; gradual wavy boundary.
- B22t—17 to 32 inches; yellowish brown (10YR 5/6) clay; common fine distinct light brownish gray mottles; weak fine angular blocky structure; very firm; few medium roots; thick continuous clay films on faces of peds; few slickensides; slightly acid; abrupt smooth boundary.
- Cr—32 to 34 inches; soft, highly fractured, level-bedded dolomite that can be cut with difficulty with a spade.
- R—34 to 36 inches; hard, level-bedded dolomite bedrock, with cracks that are more than 4 inches apart.

The solum ranges from 24 to 40 inches in thickness. Bedrock is at a depth of 24 to 40 inches. The A and B21t horizons range from medium acid to neutral, and the B22t horizon ranges from slightly acid to mildly alkaline.

The A horizon ranges from 4 to 10 inches in thickness. The A1 horizon has hue of 10YR, value of 3, and chroma of 2 or 3. The A2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The Ap horizon, where present, has colors similar to the A2 horizon. The

content of chert in the A horizon ranges from 15 to 35 percent.

The B21t horizon has hue of 10YR or 2.5Y, value of 5, and chroma of 4 or 6. It is mottled in shades of gray and red. The B22t horizon has hue of 10YR or 2.5Y, value of 5, and chroma of 4 or 6 or hue of 7.5YR, value of 5, and chroma of 6. It is mottled in shades of gray, red, or brown. The B horizon is clay or cherty clay. The content of chert in the B horizon ranges from 0 to 20 percent.

In some pedons a Cr horizon is present. It is rippable, soft, highly weathered dolomite or calcareous shale. The Cr horizon ranges from 1 to 4 inches thick.

The R horizon is hard, level-bedded dolomite bedrock.

Wideman series

The Wideman series consists of deep, excessively drained, moderately rapidly permeable soils formed in sandy alluvium. These are level to gently sloping soils on flood plains and natural levees along streams. These soils are frequently flooded. The native vegetation is bottom land hardwoods and bamboo cane. Slope ranges from 0 to 5 percent.

Wideman soils are geographically associated with Britwater, Healing, and Razort soils. Britwater soils are on adjacent higher terraces. They have a fine-loamy control section and have a redder subsoil. Healing soils are at higher elevations. They have a dark-colored surface layer and have a fine-silty control section. Razort soils are on similar landscapes. They have a dark-colored surface layer and a fine-loamy control section.

Typical pedon of Wideman sandy loam, frequently flooded, in a meadow in the SW1/4SW1/4NE1/4 sec. 2, T. 18 N., R. 16 W. in Marion County:

- Ap—0 to 6 inches; dark yellowish brown (10YR 4/4) sandy loam; weak fine granular structure; very friable; many fine roots; slightly acid; abrupt smooth boundary.
- C1—6 to 15 inches; light yellowish brown (10YR 6/4) loamy sand; single grained; very friable; few fine roots; 2 percent rounded gravel; few thin dark yellowish brown streaks; slightly acid; abrupt smooth boundary.
- C2—15 to 21 inches; very pale brown (10YR 7/4) loamy sand; single grained; very friable; few fine roots; few small pockets of dark yellowish brown (10YR 4/4)

fine sandy loam; medium acid; abrupt smooth boundary.

- C3—21 to 24 inches; dark yellowish brown (10YR 4/4) fine sandy loam; massive; friable; few fine roots; few fine pores; many irregular streaks of very pale brown (10YR 7/4) loamy sand; medium acid; abrupt smooth boundary.
- C4—24 to 27 inches; light yellowish brown (10YR 6/4) loamy sand; single grained; very friable; 5 percent rounded gravel; few bedding planes of dark yellowish brown (10YR 4/4) sandy loam, approximately one-fourth inch thick; medium acid; abrupt smooth boundary.
- C5—27 to 30 inches; dark yellowish brown (10YR 4/4) gravelly sandy loam; massive; very friable; common bedding planes of light yellowish brown (10YR 6/4) loamy sand, approximately one-fourth inch thick; 20 percent rounded gravel; slightly acid; abrupt smooth boundary.
- C6—30 to 43 inches; very pale brown (10YR 7/4) loamy sand; single grained; very friable; 10 percent rounded gravel; many fine dark yellowish brown (10YR 4/4) streaks; neutral; abrupt smooth boundary.
- C7—43 to 52 inches; light yellowish brown (10YR 6/4) loamy sand; single grained; many bedding planes of dark yellowish brown (10YR 4/4) sandy loam, approximately one-fourth inch thick; neutral; abrupt smooth boundary.
- C8—52 to 80 inches; very pale brown (10YR 7/4) sand; single grained; 10 percent rounded gravel; neutral.

The sandy sediment is from 60 to more than 80 inches thick. The A horizon is medium acid or strongly acid, except where the surface layer has been limed. The C horizon ranges from medium acid to neutral.

The Ap horizon has hue of 10YR, value of 3, 4, or 5, and chroma of 2, 3, or 4. The A horizon ranges from 2 to 9 inches in thickness.

The C horizon has hue of 10YR, value of 4, 5, 6, or 7, and chroma of 2, 3, or 4. The control section is at a depth of 10 to 40 inches. It is dominantly loamy sand or fine sand and contains thin strata of loamy very fine sand or finer textures. The content of coarse fragments, dominantly gravel, ranges from 0 to 35 percent by volume in lenses in the lower part of some C horizons.

formation of the soils

This section discusses the factors of soil formation and relates them to the formation of the soils in the survey area. It also explains the processes of soil horizon differentiation.

factors of soil formation

Soil is a collection of three-dimensional natural bodies on the earth's surface. It has properties resulting from the integrated effect of climate and living matter acting on parent material, as conditioned by relief, over long periods of time.

The interaction of five main factors results in differences among soils. These factors are the physical and chemical composition of the parent material, the climate during and after accumulation of the parent material, the kinds of plants and organisms living on and in the soil, the relief of the land and its effect on runoff, and the length of time it took the soil to form (7).

The effect of any one factor can differ from place to place, but the interaction of all factors determines the kind of soil that forms. In the following paragraphs the factors of soil formation as they relate to the soils in the survey area are discussed.

living organisms

The higher plants and the activity of animals, as well as that of insects, bacteria, and fungi, are important in the formation of soils. Plants and animals cause the soil to gain organic matter and nitrogen, gain or lose plant nutrients, and undergo change in structure and porosity.

Before Baxter and Marion Counties were settled, the native vegetation had more influence on soil formation than animal activity did. Forests of hardwoods or mixed hardwoods and shortleaf pine covered most of the counties. Small, gently sloping areas with sparse stands of hardwoods and an understory of tall prairie grasses were scattered throughout the counties. In the northeastern part of both counties, there were savannas on moderately deep and shallow upland soils overlying dolomite. The vegetation on these savannas was eastern redcedar mixed in places with hardwoods; tall grasses grew in the openings. Arkana and Moko soils are dominant in these areas.

The native vegetation on most of the rolling to steep, dissected uplands was forests of oak and hickory mixed with stands of shortleaf pine. Only the uppermost few inches of the soils in these areas have a significant

accumulation of organic matter and are dark colored. Clarksville, Doniphan, Estate, Gassville, Mountainburg, Nixa, and Noark soils formed on these uplands. They differ mainly in parent material, relief, age, and degree of weathering.

On several small, gently sloping upland areas the native vegetation was mostly scattered post oaks and an understory of tall grasses, such as big bluestem, little bluestem, indiagrass, and switchgrass, and a variety of forbs. The soils in these areas have a surface layer that is slightly dark to a depth of several inches. The darkness is due to accumulated organic matter.

In the alluvial areas the native vegetation was mainly hardwoods, such as cottonwood, sycamore, elm, black walnut, ash, oak, and hickory. Elsay, Healing, Razort, and Wideman soils formed in these areas.

The native vegetation in these counties varied partly because of changes in the available water capacity and in surface and internal drainage of the soils and, to a lesser extent, because of slope and soil fertility.

The characteristics of the soils reflect only the major differences in the original vegetation.

Man also affects the rate and direction of soil formation. He clears the forests, cultivates the soils, and introduces new kinds of plants. He adds fertilizer, organic residue, lime, and chemicals for insect, disease, and weed control. He affects the development of all soils by building dams, grading the surface, cutting and filling, compacting, covering the soil with buildings and pavements, and cultivating erodible areas. Some of the results of these changes may not be evident for many centuries. Nevertheless, man has drastically affected soil formation in these counties.

relief

The relief in Baxter and Marion Counties is the result of the uplifting of Paleozoic rocks and the subsequent erosion and the entrenchment of streams and drainage channels into the land surface. The highest elevation in Baxter County, about 1,409 feet above sea level, is south of Lone Rock in the southern part of the county. The lowest elevation, about 330 feet above sea level, is where the White River leaves the county. The highest elevation in Marion County, about 1,345 feet above sea level, is in the northwestern part of the county. The lowest elevation, about 370 feet above sea level, is at the confluence of the Buffalo and White Rivers in the southeastern part of the county.

Differences in relief, through its effect on drainage, runoff, erosion, and percolation of water through the soil, cause some of the greatest differences in the soils of Baxter and Marion Counties. The relief ranges from near vertical bluffs to broad, nearly level to gently sloping areas.

In places the soils on the steeper slopes, narrow ridges, and hilltops are shallow because they have lost much soil material through geologic erosion; examples are Moko and Mountainburg soils. In other areas of strong relief, Clarksville, Nixa, and Noark soils formed in cherty limestone. These soils contain large quantities of chert residue from the cherty limestone. This chert mantle retards geologic erosion. In contrast, nearly level to moderately sloping soils on uplands, for example, Captina, Sidon, and Tonti soils, have lost little soil material. These soils contain few coarse fragments in the upper part of the profile and are moderately deep or deep.

Some foot slopes have deep accumulations of material that washed or sloughed from adjacent higher slopes. Portia soils formed in this material. Britwater soils on nearly level to moderately sloping stream terraces formed in deep, loamy and silty material. This material was washed from uplands and deposited in stream flood plains before the streams were further entrenched.

The present flood plains along streams in the survey area are level to gently sloping. They are subject to frequent flooding unless protected by flood retarding structures upstream. Healing, Razort, and Wideman soils formed in these areas in deep, silty, loamy, or sandy alluvial deposits.

parent material

The soils of Baxter and Marion Counties formed in material that weathered from consolidated bedrock of the Ordovician and Mississippian Periods (3, 5).

Approximately all of the northern two-thirds of Baxter and Marion Counties is on the Salem Plateau. The Cotter and Jefferson City Formations of the Lower Ordovician Period cover most of the plateau, except where it is capped by limestone and sandstone of the Powell, St. Peter, and Everton Formations of the same period. The Cotter and Jefferson City Formations are exposed over most of northern Baxter and Marion Counties. These formations consist of fine-grained, gray dolomite (4). They also contain chert. Arkana, Doniphan, Gassville, and Moko soils formed in residuum from these formations.

St. Peter Sandstone, Powell Limestone, and Everton Limestone of the Middle Ordovician Period are exposed in central Baxter County and to a lesser extent in central and southern Marion County. These formations consist mainly of massive, light-colored, medium- to fine-grained, friable sandstone and gray limestone (4). Brockwell, Estate, and Portia soils formed in residuum from these formations.

The Boone Formation of the Mississippian Period overlies St. Peter Sandstone, Powell Limestone, Everton Limestone, and other minor formations in Baxter and Marion Counties. This formation forms the Springfield Plateau. It consists of alternating beds of limestone and chert or of nodules of chert in limestone that was deposited by marine waters. The amount of chert varies both vertically and laterally within the formation. The limestone weathers more rapidly than the chert. Clarksville, Nixa, and Noark soils, which contain large quantities of chert, formed in these dissected areas.

An outlier of the Boston Mountains rises above the Springfield Plateau in extreme southwestern Baxter County. This low, flat-topped mountain is mainly shale and is capped by a sandstone more resistant to weathering than shale, probably the Batesville Sandstone of the Mississippian Period. Sidon and Mountainburg soils formed in material that weathered from the sandstone.

Elsah, Healing, Razort, and Wideman soils are on flood plains in the two counties. They formed in deep, loamy and sandy sediment that washed from local uplands. These soils differ primarily in the amount of chert or gravel in the parent material and in degree of development. Britwater soils formed in old alluvial sediment on stream terraces.

climate

Baxter and Marion Counties have relatively mild winters, warm or hot summers, and fairly abundant rainfall. The present climate probably is similar to the climate under which the soils formed. The average daily maximum temperature is 91 degrees F in July and 46 degrees in January. The annual rainfall is about 43 inches and is generally well distributed throughout the year. For additional information about the climate, refer to "General nature of the survey area."

The warm, moist climate promotes rapid soil formation and rapid chemical reactions. The large amount of water moving through the soil moves dissolved or suspended materials downward in the profile. Plant residue decomposes rapidly and forms organic acid, which hastens the removal of carbonates and the formation of clay minerals. Soil formation continues almost year round because the soil is frozen only to shallow depths and for relatively short periods. Although the climate in the counties is relatively uniform, its effect is modified locally by elevation and slope. Climate alone does not account for differences in the soils in the counties.

time

The length of time required for soil formation depends largely on other factors of soil formation. Generally, less time is required if the climate is warm and humid and the vegetation luxuriant. Also, other factors being equal, less time is required if the parent material is loamy than if it is clayey.

In terms of geologic time, most of the soils in Baxter and Marion Counties are old, regardless of whether they are on mountaintops, mountainsides, or stream terraces. The younger soils formed either in recent alluvium along streams or in residual material where geologic erosion has nearly kept pace with weathering of the bedrock.

Most of the upland soils are old and well developed. They formed in material that weathered from rock of Ordovician or Mississippian age. Most of the cations have been leached out, and reaction is strongly acid or very strongly acid. There has been considerable weathering and translocation of clay, and the horizons are clearly expressed. Iron has been translocated from the A horizon to the B horizon. There it was oxidized, causing the B horizon to have stronger red, brown, and yellow colors than the A horizon. Doniphan, Nixa, and Noark soils clearly show the impact of time acting with other soil-forming factors on parent material.

Wideman soils are young. They formed in recent alluvium on the flood plains of the White and Buffalo Rivers and Crooked Creek. No definite horizons have formed below the A horizon. Instead, these soils still have depositional bedding planes. They are structureless. Base saturation is high, and the reaction, which is neutral to moderately alkaline, indicates that leaching has been slight. The organic matter decreases irregularly with increasing depth. Except for the slight mechanical changes caused by worms and roots, there is little evidence of soil-forming activity.

The shallow Moko soils also are young soils. They formed in residuum from dolomite where geologic erosion has nearly kept pace with soil formation.

Razort and Healing soils are examples of soils of intermediate age. They formed in loamy alluvium in stream bottoms. Horizonation is weakly expressed, and there is little evidence of clay translocation. The B horizon is underlain by stratified beds of silty, sandy, and gravelly material.

processes of soil horizon differentiation

The soil-forming factors affect the soil profile, which is a succession of layers or horizons, from the surface down to the parent material. The processes of horizon differentiation have little altered the horizons. The horizons differ in one or more properties, such as color, texture, structure, consistence, porosity, and reaction.

Most soil profiles contain three major horizons: the A,

B, and C horizons. Very young soils do not have a B horizon.

The A1 horizon, or the surface layer, has the maximum accumulation of organic matter. The A2 horizon, or the subsurface layer, is the horizon of maximum leaching of dissolved or suspended materials.

The B horizon, or the subsoil, lies immediately below the A horizon (12). It has the maximum accumulation of dissolved or suspended materials, such as iron and clay. Its structure is blocky and firmer than that of the horizons immediately above or below it.

The C horizon is below the B horizon. Typically, the soil-forming processes have little affected it, though weathering sometimes has materially modified it. In some young soils the C horizon immediately underlies the A horizon, and living organisms, as well as weathering, have slightly modified it.

Several processes have been active in the formation of soil horizons in the soils of Baxter and Marion Counties. These processes include accumulation of organic matter, leaching of carbonates and bases, oxidation or reduction and transfer of iron, and formation and translocation of silicate clay minerals. In most of the soils one or more of these processes were involved.

Physical weathering—heating and cooling and wetting and drying—slowly breaks rocks into smaller pieces that form the parent material of the residual soils. Moko, Mountainburg, and Sidon soils formed this way.

The accumulation of organic matter in the upper part of the profile to form an A1 horizon is an important process of soil formation. The A1 horizon is evident in soils that have a light-colored subsurface layer from which organic matter, clay, and iron oxides have been removed. Nixa soils reflect this process.

Leaching also is an important process in the development of horizons. Most of the soils in the two counties are strongly leached. Carbonates and bases have been leached to some degree in nearly all the soils. Generally, bases are leached downward in soils before silicate clay minerals begin to move. Healing and Razort soils are moderately leached, and Moko soils are only slightly leached.

Iron has been oxidized in the moderately well drained and well drained soils in the counties, as indicated by the red and brown colors in the B horizon. Brockwell, Doniphan, and Portia soils on uplands and Britwater soils on terraces are examples.

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glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon.

Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	<i>Inches</i>
Very low.....	0 to 3
Low.....	3 to 6
Moderate.....	6 to 9
High.....	9 to 12
Very high.....	More than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless

the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion. *Erosion* (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity*, *normal moisture capacity*, or *capillary capacity*.

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 37.5 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of

soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor

aeration and impeded drainage. Descriptive terms are as follows: abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan*, *fragipan*, *claypan*, *plowpan*, and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil.

Terms describing permeability are:

Very slow.....	less than 0.06 inch
Slow.....	0.06 to 0.20 inch
Moderately slow.....	0.2 to 0.6 inch
Moderate.....	0.6 inch to 2.0 inches
Moderately rapid.....	2.0 to 6.0 inches
Rapid.....	6.0 to 20 inches
Very rapid.....	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid.....	Below 4.5
Very strongly acid.....	4.5 to 5.0
Strongly acid.....	5.1 to 5.5
Medium acid.....	5.6 to 6.0
Slightly acid.....	6.1 to 6.5
Neutral.....	6.6 to 7.3
Mildly alkaline.....	7.4 to 7.8
Moderately alkaline.....	7.9 to 8.4
Strongly alkaline.....	8.5 to 9.0
Very strongly alkaline.....	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site Index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millime- ters
Very coarse sand.....	2.0 to 1.0
Coarse sand.....	1.0 to 0.5
Medium sand.....	0.5 to 0.25
Fine sand.....	0.25 to 0.10
Very fine sand.....	0.10 to 0.05
Silt.....	0.05 to 0.002
Clay.....	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide

range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.
Wilting point (or permanent wilting point). The

moisture content of soil, on an oven-dry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

tables

TABLE 1.--LIVESTOCK AND POULTRY SOLD IN SELECTED YEARS

Livestock and poultry	Baxter County		Marion County	
	1969	1974	1969	1974
Cattle and calves-----	24,567	24,958	35,036	36,550
Pigs and hogs-----	12,256	6,887	9,577	7,522
Horses and ponies-----	429	341	561	370
Broiler chickens-----	279,904	477,779	---	---

TABLE 2.--ACREAGE OF PRINCIPAL CROPS IN SELECTED YEARS

Crop	Baxter County		Marion County	
	1969	1974	1969	1974
Pasture-----	25,565	25,082	45,640	41,675
Hay crops-----	4,907	4,774	6,089	7,103
Corn-----	102	449	191	47
Sorghum-----	440	166	394	165

TABLE 3.--TEMPERATURE AND PRECIPITATION
 [Recorded in the period 1953-77 at Mountain Home, Arkansas]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have--		Average number of growing degree days ¹	Average	2 years in 10 will have--		Average number of days with 0.10 inch or more	Average snowfall
				Maximum temperature higher than--	Minimum temperature lower than--			Less than--	More than--		
	<u>°F</u>	<u>°F</u>	<u>°F</u>	<u>°F</u>	<u>°F</u>	<u>Units</u>	<u>In</u>	<u>In</u>	<u>In</u>		<u>In</u>
January----	45.8	21.9	33.9	74	-1	8	2.30	.96	3.38	4	2.2
February---	50.9	26.1	38.5	77	5	14	2.74	1.30	3.91	5	1.9
March-----	58.8	34.1	46.5	85	13	114	3.80	1.61	5.57	7	1.5
April-----	71.1	45.8	58.5	90	24	268	4.47	2.52	6.05	7	.0
May-----	78.4	54.3	66.3	91	34	505	5.07	2.56	7.12	8	.0
June-----	85.6	62.5	74.1	98	46	723	4.26	2.20	5.93	7	.0
July-----	90.8	66.5	78.7	103	51	890	3.20	1.74	4.38	6	.0
August-----	89.6	64.4	77.0	102	50	837	2.93	1.56	4.04	5	.0
September--	82.9	57.5	70.2	98	38	606	4.17	1.85	6.05	6	.0
October----	73.3	44.7	59.0	91	26	295	3.12	1.00	4.80	4	.0
November---	59.8	33.7	46.8	82	12	54	3.73	1.48	5.54	5	.8
December---	49.3	25.9	37.6	75	3	10	3.31	1.23	4.97	5	2.1
Yearly:											
Average--	69.7	44.8	57.3	---	---	---	---	---	---	---	---
Extreme--	---	---	---	104	-3	---	---	---	---	---	---
Total----	---	---	---	---	---	4,324	43.10	35.31	50.49	69	8.5

¹A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 4.--FREEZE DATES IN SPRING AND FALL
[Recorded in the period 1953-77 at Mountain
Home, Arkansas]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 9	April 15	April 29
2 years in 10 later than--	April 3	April 11	April 23
5 years in 10 later than--	March 21	April 2	April 12
First freezing temperature in fall:			
1 year in 10 earlier than--	October 29	October 19	October 7
2 years in 10 earlier than--	November 3	October 22	October 12
5 years in 10 earlier than--	November 12	October 30	October 22

TABLE 5.--GROWING SEASON
[Recorded in the period 1953-77 at Mountain
Home, Arkansas]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	213	194	171
8 years in 10	221	199	178
5 years in 10	235	210	192
2 years in 10	249	221	205
1 year in 10	257	227	213

TABLE 6.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Baxter county Acres	Marion county Acres	Total--	
				Area Acres	Extent Pct
1	Arkana very cherty silt loam, 3 to 8 percent slopes-----	3,530	4,625	8,155	1.0
2	Arkana-Moko complex, 3 to 8 percent slopes-----	5,225	4,890	10,115	1.3
3	Arkana-Moko complex, 8 to 20 percent slopes-----	21,135	20,485	41,620	5.4
4	Arkana-Moko complex, 20 to 40 percent slopes-----	55,325	59,375	114,700	14.8
5	Britwater silt loam, 1 to 3 percent slopes-----	550	675	1,225	0.2
6	Britwater silt loam, 3 to 8 percent slopes-----	1,790	1,200	2,990	0.4
7	Britwater gravelly silt loam, 3 to 8 percent slopes-----	1,940	1,845	3,785	0.5
8	Brockwell sandy loam, 3 to 8 percent slopes-----	1,680	40	1,720	0.2
9	Brockwell gravelly sandy loam, 3 to 8 percent slopes-----	7,405	90	7,495	1.0
10	Brockwell gravelly sandy loam, 8 to 20 percent slopes-----	6,095	475	6,570	0.8
11	Captina silt loam, 1 to 3 percent slopes-----	2,325	660	2,985	0.4
12	Captina silt loam, 3 to 8 percent slopes-----	3,015	550	3,565	0.5
13	Clarksville very cherty silt loam, 20 to 50 percent slopes	19,570	52,425	71,995	9.3
14	Doniphan very cherty silt loam, 3 to 8 percent slopes-----	26,550	14,205	40,755	5.2
15	Doniphan very cherty silt loam, 8 to 20 percent slopes-----	47,930	18,475	66,405	8.5
16	Elsah cherty loam, frequently flooded-----	1,515	1,150	2,665	0.3
17	Estate-Portia-Moko association, rolling-----	7,820	20,355	28,175	3.6
18	Estate-Portia-Moko association, steep-----	30,410	58,875	89,285	11.5
19	Gassville very cherty silt loam, 20 to 40 percent slopes---	23,490	9,430	32,920	4.2
20	Healing silt loam, 1 to 3 percent slopes-----	3,520	1,230	4,750	0.6
21	Moko-Rock outcrop complex, 3 to 15 percent slopes-----	550	880	1,430	0.2
22	Moko-Rock outcrop complex, 15 to 40 percent slopes-----	1,980	3,060	5,040	0.6
23	Mountainburg gravelly loam, 3 to 8 percent slopes-----	545	0	545	0.1
24	Mountainburg very stony sandy loam, 3 to 15 percent slopes	760	0	760	0.1
25	Mountainburg very stony sandy loam, 15 to 40 percent slopes	615	0	615	0.1
26	Nixa very cherty silt loam, 3 to 8 percent slopes-----	7,565	10,455	18,020	2.3
27	Nixa very cherty silt loam, 8 to 12 percent slopes-----	6,760	17,350	24,110	3.1
28	Nixa-Doniphan complex, 3 to 8 percent slopes-----	15,935	4,930	20,865	2.7
29	Nixa-Doniphan complex, 8 to 20 percent slopes-----	2,835	2,705	5,540	0.7
30	Nixa-Noark complex, 3 to 8 percent slopes-----	75	2,125	2,200	0.3
31	Nixa-Noark complex, 8 to 20 percent slopes-----	3,765	17,795	21,560	2.8
32	Noark very cherty silt loam, 3 to 8 percent slopes-----	360	2,455	2,815	0.4
33	Noark very cherty silt loam, 8 to 20 percent slopes-----	2,350	6,400	8,750	1.1
34	Noark very cherty silt loam, 20 to 40 percent slopes-----	2,740	7,900	10,640	1.4
35	Portia fine sandy loam, 3 to 8 percent slopes-----	3,985	5,040	9,025	1.2
36	Portia fine sandy loam, 8 to 12 percent slopes-----	3,635	7,455	11,090	1.4
37	Razort silt loam, frequently flooded-----	3,275	4,685	7,960	1.0
38	Sidon silt loam, 3 to 8 percent slopes-----	1,440	0	1,440	0.2
39	Tonti cherty silt loam, 3 to 8 percent slopes-----	3,830	2,355	6,185	0.8
40	Udorthents-Ramsey-Rock outcrop complex, 3 to 20 percent slopes-----	1,700	0	1,700	0.2
41	Ventris cherty silt loam, 3 to 8 percent slopes-----	4,770	130	4,900	0.6
42	Wideman sandy loam, frequently flooded-----	635	3,395	4,030	0.5
	Large water ¹ -----	26,175	34,050	60,225	7.7
	Small water ² -----	2,820	3,460	6,280	0.8
	Total-----	369,920	407,680	777,600	100.0

¹ Enclosed areas of water more than 40 acres in size, and streams, sloughs, and canals more than one-eighth of a statute mile in width.

² Enclosed areas of water less than 40 acres in size, and streams, sloughs, and canals less than one-eighth of a statute mile in width.

TABLE 7.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn	Oats	Tall fescue	Improved bermudagrass
	<u>Bu</u>	<u>Bu</u>	<u>AUM#</u>	<u>AUM#</u>
1----- Arkana	---	---	4.5	---
2----- Arkana-Moko	---	---	3.5	---
3----- Arkana-Moko	---	---	3.0	---
4----- Arkana-Moko	---	---	---	---
5----- Britwater	75	70	8.0	7.5
6, 7----- Britwater	65	60	7.0	7.0
8, 9----- Brockwell	60	60	5.5	6.0
10----- Brockwell	---	---	4.5	5.0
11----- Captina	65	65	7.5	7.0
12----- Captina	60	60	7.0	6.5
13----- Clarksville	---	---	---	---
14----- Doniphan	---	45	5.5	5.0
15----- Doniphan	---	---	4.5	4.0
16----- Elsah	---	---	7.5	7.5
17**: Estate-----	---	---	5.0	---
Portia-----	---	---	5.5	5.5
Moko-----	---	---	1.5	---
18**: Estate-----	---	---	---	---
Portia-----	---	---	---	---
Moko-----	---	---	---	---
19----- Gassville	---	---	---	---
20----- Healing	85	70	9.5	9.5
21----- Moko-Rock outcrop	---	---	---	---

See footnote at end of table.

TABLE 7.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Oats	Tall fescue	Improved bermudagrass
	<u>Bu</u>	<u>Bu</u>	<u>AUM*</u>	<u>AUM*</u>
22----- Moko-Rock outcrop	---	---	---	---
23----- Mountainburg	---	35	3.0	4.0
24----- Mountainburg	---	---	---	---
25----- Mountainburg	---	---	---	---
26----- Nixa	---	45	5.5	5.0
27----- Nixa	---	---	5.0	4.0
28----- Nixa-Doniphan	---	---	5.5	5.0
29----- Nixa-Doniphan	---	---	5.0	4.0
30----- Nixa-Noark	---	---	6.0	5.5
31----- Nixa-Noark	---	---	5.0	4.5
32----- Noark	55	50	6.5	6.0
33----- Noark	---	---	5.5	5.0
34----- Noark	---	---	---	---
35----- Portia	70	60	6.5	7.0
36----- Portia	---	50	6.0	6.0
37----- Razort	80	70	9.0	9.0
38----- Sidon	60	65	5.5	6.0
39----- Tonti	65	70	7.0	7.0
40----- Udorthents-Ramsey-Rock outcrop	---	---	---	---
41----- Ventriss	---	---	4.5	---
42----- Wideman	50	50	4.0	5.0

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Absence of an entry indicates that information was not available]

Soil name and map symbol	Wood-land suitability group	Management concerns			Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Common trees	Site index	
1----- Arkana	5c8	Slight	Slight	Moderate	Shortleaf pine----- Southern red oak----- Eastern redcedar----- White oak-----	55 55 35 ---	Shortleaf pine, eastern redcedar.
2*: Arkana-----	5c8	Slight	Slight	Moderate	Shortleaf pine----- Southern red oak----- Eastern redcedar----- White oak-----	55 55 35 ---	Shortleaf pine, eastern redcedar.
Moko-----	5x3	Moderate	Severe	Moderate	Eastern redcedar-----	30	Eastern redcedar.
3*: Arkana-----	5c8	Slight	Moderate	Moderate	Shortleaf pine----- Southern red oak----- Eastern redcedar----- White oak-----	55 55 35 ---	Shortleaf pine, eastern redcedar.
Moko-----	5x3	Severe	Severe	Severe	Eastern redcedar-----	30	Eastern redcedar.
4*: Arkana-----	5c9	Moderate	Severe	Severe	Shortleaf pine----- Southern red oak----- Eastern redcedar----- White oak-----	55 55 35 ---	Shortleaf pine, eastern redcedar.
Moko-----	5x3	Severe	Severe	Severe	Eastern redcedar-----	30	Eastern redcedar.
5, 6, 7----- Britwater	3o7	Slight	Slight	Slight	Shortleaf pine----- Southern red oak----- Eastern redcedar-----	70 70 50	Shortleaf pine, southern red oak, eastern redcedar, loblolly pine.
8, 9, 10----- Brockwell	3o7	Slight	Slight	Slight	Shortleaf pine----- Southern red oak----- Black oak----- White oak-----	70 66 --- ---	Shortleaf pine, loblolly pine.
11, 12----- Captina	4o7	Slight	Slight	Slight	Shortleaf pine----- Southern red oak----- Eastern redcedar----- Black locust----- Black walnut-----	60 65 40 --- ---	Shortleaf pine, eastern redcedar, black walnut, black locust, southern red oak.
13----- Clarksville	4f9	Moderate	Severe	Severe	White oak----- Shortleaf pine-----	55 55	White oak, shortleaf pine, sweetgum.
14----- Doniphan	3o7	Slight	Slight	Slight	White oak----- Shortleaf pine-----	70 70	Shortleaf pine, white oak, sweetgum, black oak.

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Wood-land suitability group	Management concerns			Potential productivity		Trees to plant
		Erosion hazard	Equip-ment limitation	Seedling mortality	Common trees	Site index	
15----- Doniphan	3r8	Moderate	Slight	Moderate	White oak----- Shortleaf pine-----	70 70	Shortleaf pine, white oak, sweetgum, black oak.
16----- Elsah	3f5	Slight	Slight	Moderate	Eastern cottonwood----- American sycamore----- Sweetgum-----	95 --- ---	Black walnut, sweetgum, American sycamore.
17*: Estate-----	4x8	Moderate	Moderate	Slight	Southern red oak----- Eastern redcedar----- Black walnut----- Shortleaf pine----- Black locust----- White oak----- Black cherry-----	65 40 --- 60 --- --- ---	Shortleaf pine, loblolly pine, eastern redcedar.
Portia-----	3r8	Moderate	Slight	Slight	Southern red oak----- Sweetgum----- Shortleaf pine----- White oak-----	--- 80 75 ---	Loblolly pine, shortleaf pine.
Moko-----	5x3	Severe	Severe	Severe	Eastern redcedar-----	30	Eastern redcedar.
18*: Estate-----	4x9	Severe	Severe	Slight	Southern red oak----- Eastern redcedar----- Black walnut----- Shortleaf pine----- Black locust----- White oak----- Black cherry-----	65 40 --- 60 --- --- ---	Shortleaf pine, loblolly pine, eastern redcedar.
Portia-----	3r8	Moderate	Moderate	Slight	Southern red oak----- Sweetgum----- Shortleaf pine----- White oak-----	--- 80 75 ---	Loblolly pine, shortleaf pine.
Moko-----	5x3	Severe	Severe	Severe	Eastern redcedar-----	30	Eastern redcedar.
19----- Gassville	4r9	Moderate	Severe	Moderate	Shortleaf pine----- Southern red oak----- Black locust----- Black walnut----- Black cherry----- Eastern redcedar-----	56 65 --- --- --- 36	Shortleaf pine, eastern redcedar, loblolly pine, black locust, southern red oak.
20----- Healing	2o7	Slight	Slight	Slight	Shortleaf pine----- Southern red oak----- White oak----- American sycamore----- Eastern cottonwood-----	80 80 70 80 96	Shortleaf pine, southern red oak, white oak, American sycamore, eastern cottonwood, black walnut.
21*: Moko----- Rock outcrop.	5x3	Moderate	Severe	Moderate	Eastern redcedar-----	30	Eastern redcedar.
22*: Moko----- Rock outcrop.	5x3	Severe	Severe	Severe	Eastern redcedar-----	30	Eastern redcedar.

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Wood-land suitability group	Management concerns			Potential productivity		Trees to plant
		Erosion hazard	Equip-ment limitation	Seedling mortality	Common trees	Site index	
23----- Mountainburg	5d2	Slight	Slight	Moderate	Shortleaf pine----- Eastern redcedar-----	50 30	Shortleaf pine, eastern redcedar, loblolly pine.
24----- Mountainburg	5x3	Slight	Severe	Moderate	Shortleaf pine----- Eastern redcedar-----	50 30	Shortleaf pine, eastern redcedar, loblolly pine.
25----- Mountainburg	5x3	Severe	Severe	Moderate	Shortleaf pine----- Eastern redcedar-----	50 30	Shortleaf pine, eastern redcedar, loblolly pine.
26; 27----- Nixa	4f8	Slight	Slight	Moderate	Shortleaf pine----- Southern red oak----- White oak----- Eastern redcedar----- Black walnut----- Black locust-----	60 60 60 40 --- ---	Shortleaf pine, loblolly pine, eastern redcedar, black locust, southern red oak.
28*: Nixa-----	4f8	Slight	Slight	Moderate	Shortleaf pine----- Southern red oak----- White oak----- Eastern redcedar----- Black walnut----- Black locust-----	60 60 60 40 --- ---	Shortleaf pine, loblolly pine, eastern redcedar, black locust, southern red oak.
Doniphan-----	3o7	Slight	Slight	Slight	White oak----- Shortleaf pine-----	70 70	Shortleaf pine, white oak, sweetgum, black oak.
29*: Nixa-----	4f8	Slight	Slight	Moderate	Shortleaf pine----- Southern red oak----- White oak----- Eastern redcedar----- Black walnut----- Black locust-----	60 60 60 40 --- ---	Shortleaf pine, loblolly pine, eastern redcedar, black locust, southern red oak.
Doniphan-----	3r8	Moderate	Slight	Moderate	White oak----- Shortleaf pine-----	70 70	Shortleaf pine, white oak, sweetgum, black oak.
30*, 31*: Nixa-----	4f8	Slight	Slight	Moderate	Shortleaf pine----- Southern red oak----- White oak----- Eastern redcedar----- Black walnut----- Black locust-----	60 60 60 40 --- ---	Shortleaf pine, loblolly pine, eastern redcedar, black locust, southern red oak.
Noark-----	4f8	Slight	Slight	Moderate	Shortleaf pine----- Eastern redcedar----- Southern red oak----- White oak-----	60 40 60 ---	Shortleaf pine, eastern redcedar, southern red oak.
32, 33----- Noark	4f8	Slight	Slight	Moderate	Shortleaf pine----- Eastern redcedar----- Southern red oak----- White oak-----	60 40 60 ---	Shortleaf pine, eastern redcedar, southern red oak.

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Wood-land suitability group	Management concerns			Potential productivity		Trees to plant
		Erosion hazard	Equip-ment limitation	Seedling mortality	Common trees	Site index	
34----- Noark	4r9	Moderate	Severe	Moderate	Shortleaf pine----- Eastern redcedar----- Southern red oak----- White oak-----	60 40 60 ---	Shortleaf pine, eastern redcedar, southern red oak.
35, 36----- Portia	3o7	Slight	Slight	Slight	Sweetgum----- Shortleaf pine----- White oak----- Southern red oak-----	80 75 --- ---	Loblolly pine, shortleaf pine.
37----- Razort	2o7	Slight	Slight	Slight	Shortleaf pine----- Southern red oak----- Eastern cottonwood----- American sycamore----- Sweetgum----- White oak-----	80 80 96 85 86 75	Shortleaf pine, loblolly pine, southern red oak, white oak, black walnut, American sycamore, eastern cottonwood, sweetgum.
38----- Sidon	3o7	Slight	Slight	Slight	Northern red oak----- White oak----- Shortleaf pine-----	--- 70 70	Loblolly pine, shortleaf pine, white oak.
39----- Tonti	4o7	Slight	Slight	Slight	Shortleaf pine----- Southern red oak----- Black locust----- Black walnut----- Eastern redcedar-----	60 65 --- --- 40	Shortleaf pine, eastern redcedar, black walnut, black locust, southern red oak.
40*: Udorthents.							
Ramsey-----	5x9	Severe	Severe	Severe	White oak----- Shortleaf pine----- Eastern redcedar-----	50 55 30	Shortleaf pine, loblolly pine, white oak, eastern redcedar.
Rock outcrop.							
41----- Ventris	5c2	Slight	Slight	Moderate	Shortleaf pine----- Southern red oak----- Eastern redcedar-----	55 55 35	Shortleaf pine, loblolly pine, eastern redcedar.
42----- Wideman	3s8	Slight	Moderate	Moderate	Sweetgum----- Eastern cottonwood----- American sycamore-----	80 90 80	Eastern cottonwood, American sycamore, loblolly pine, shortleaf pine, sweetgum.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
1----- Arkana	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly, small stones.	Slight.
2*: Arkana-----	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly, small stones.	Slight.
Moko-----	Severe: depth to rock.	Severe: depth to rock.	Severe: large stones, depth to rock.	Severe: large stones.
3*: Arkana-----	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly, slope, small stones.	Slight.
Moko-----	Severe: depth to rock.	Severe: depth to rock.	Severe: large stones, slope, depth to rock.	Severe: large stones.
4*: Arkana-----	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: percs slowly, slope, small stones.	Severe: slope.
Moko-----	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: large stones, slope, depth to rock	Severe: large stones, slope.
5----- Britwater	Slight-----	Slight-----	Slight-----	Slight.
6----- Britwater	Slight-----	Slight-----	Moderate: slope.	Slight.
7----- Britwater	Moderate: small stones.	Moderate: small stones.	Moderate: slope, small stones.	Slight.
8----- Brockwell	Slight-----	Slight-----	Moderate: slope, small stones.	Slight.
9----- Brockwell	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight.
10----- Brockwell	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight.
11, 12----- Captina	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Slight.
13----- Clarksville	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
14----- Doniphan	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight.
15----- Doniphan	Moderate: small stones, slope.	Moderate: small stones, slope.	Severe: slope, small stones.	Slight.
16----- Elsah	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
17*: Estate-----	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope.	Moderate: large stones.
Portia-----	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight.
Moko-----	Severe: depth to rock.	Severe: depth to rock.	Severe: large stones, slope, depth to rock.	Severe: large stones.
18*: Estate-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Portia-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Moko-----	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: large stones, slope, depth to rock.	Severe: large stones, slope.
19----- Gassville	Severe: slope, small stones, percs slowly.	Severe: slope, small stones, percs slowly.	Severe: slope, small stones, percs slowly.	Severe: erodes easily, small stones.
20----- Healing	Slight-----	Slight-----	Slight-----	Slight.
21*: Moko-----	Severe: depth to rock.	Severe: depth to rock.	Severe: large stones, slope, depth to rock.	Severe: large stones.
Rock outcrop.				
22*: Moko-----	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: large stones, slope, depth to rock.	Severe: large stones, slope.
Rock outcrop.				
23----- Mountainburg	Severe: depth to rock.	Severe: depth to rock.	Severe: small stones, depth to rock.	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
24----- Mountainburg	Severe: small stones, depth to rock.	Severe: small stones, depth to rock.	Severe: large stones, slope, depth to rock.	Severe: large stones, small stones.
25----- Mountainburg	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: large stones, slope, depth to rock.	Severe: large stones, slope, small stones.
26----- Nixa	Severe: small stones, percs slowly.	Severe: small stones, percs slowly.	Severe: small stones, percs slowly.	Slight.
27----- Nixa	Severe: small stones, percs slowly.	Severe: small stones, percs slowly.	Severe: slope, small stones, percs slowly.	Severe: erodes easily.
28*: Nixa-----	Severe: small stones, percs slowly.	Severe: small stones, percs slowly.	Severe: small stones, percs slowly.	Slight.
Doniphan-----	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight.
29*: Nixa-----	Severe: small stones, percs slowly.	Severe: small stones, percs slowly.	Severe: slope, small stones, percs slowly.	Severe: erodes easily.
Doniphan-----	Moderate: small stones, slope.	Moderate: small stones, slope.	Severe: slope, small stones.	Moderate: slope.
30*: Nixa-----	Severe: small stones, percs slowly.	Severe: small stones, percs slowly.	Severe: small stones, percs slowly.	Slight.
Noark-----	Severe: small stones.	Severe: small stones.	Severe: small stones.	Slight.
31*: Nixa-----	Severe: small stones, percs slowly.	Severe: small stones, percs slowly.	Severe: slope, small stones, percs slowly.	Severe: erodes easily.
Noark-----	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Moderate: slope.
32----- Noark	Severe: small stones.	Severe: small stones.	Severe: small stones.	Slight.
33----- Noark	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Moderate: slope.
34----- Noark	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.
35----- Portia	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
36----- Portia	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight.
37----- Razort	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
38----- Sidon	Moderate: percs slowly, wetness.	Moderate: percs slowly, wetness.	Moderate: slope, percs slowly, wetness.	Slight.
39----- Tonti	Moderate: percs slowly, wetness, small stones.	Moderate: wetness, percs slowly, small stones.	Moderate: percs slowly, slope, wetness.	Slight.
40*: Udorthents.				
Ramsey----- Rock outcrop.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock, small stones.	Moderate: large stones.
41----- Ventriss	Severe: percs slowly.	Severe: percs slowly.	Severe: small stones, percs slowly.	Slight.
42----- Wideman	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
1----- Arkana	Fair	Good	Fair	Good	---	Poor	Very poor.	Fair	Good	Very poor.
2*: Arkana-----	Fair	Good	Fair	Good	---	Poor	Very poor.	Fair	Good	Very poor.
Moko-----	Very poor.	Poor	Poor	---	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
3*: Arkana-----	Fair	Good	Fair	Good	---	Very poor.	Very poor.	Fair	Good	Very poor.
Moko-----	Very poor.	Poor	Poor	---	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
4*: Arkana-----	Very poor.	Fair	Fair	Good	---	Very poor.	Very poor.	Poor	Good	Very poor.
Moko-----	Very poor.	Poor	Poor	---	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
5----- Britwater	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
6, 7----- Britwater	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
8, 9----- Brockwell	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
10----- Brockwell	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
11----- Captina	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
12----- Captina	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
13----- Clarksville	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
14----- Doniphan	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
15----- Doniphan	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
16----- Elsah	Fair	Fair	Fair	Good	Fair	Poor	Poor	Fair	Good	Poor.
17*: Estate-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Portia-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
17*: Moko-----	Very poor.	Poor	Poor	---	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
18*: Estate-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Portia-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Moko-----	Very poor.	Poor	Poor	---	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
19----- Gassville	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
20----- Healing	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
21*, 22*: Moko-----	Very poor.	Poor	Poor	---	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Rock outcrop.										
23----- Mountainburg	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Very poor.	Poor	Very poor.	Very poor.
24, 25----- Mountainburg	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Poor	Very poor.
26----- Nixa	Poor	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
27----- Nixa	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
28*: Nixa-----	Poor	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
Doniphan-----	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
29*: Nixa-----	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Doniphan-----	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
30*: Nixa-----	Poor	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
Noark-----	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
31*: Nixa-----	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Noark-----	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
32, 33----- Noark	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
34----- Noark	Very poor.	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
35----- Portia	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
36----- Portia	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
37----- Razort	Poor	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
38----- Sidon	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
39----- Tont1	Fair	Good	Good	Fair	Fair	Poor	Poor	Good	Fair	Very poor.
40*: Udorthents.										
Ramsey----- Rock outcrop.	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
41----- Ventr1s	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
42----- Wideman	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
1----- Arkana	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
2*: Arkana-----	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Moko-----	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.
3*: Arkana-----	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
Moko-----	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, large stones.
4*: Arkana-----	Severe: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: depth to rock, slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.
Moko-----	Severe: depth to rock, large stones, slope.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.
5----- Britwater	Slight-----	Slight-----	Slight-----	Slight-----	Moderate: low strength.
6, 7----- Britwater	Slight-----	Slight-----	Slight-----	Moderate: slope.	Moderate: low strength.
8, 9----- Brockwell	Slight-----	Slight-----	Slight-----	Moderate: slope.	Slight.
10----- Brockwell	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
11----- Captina	Moderate: too clayey, wetness.	Moderate: wetness.	Severe: shrink-swell, wetness.	Moderate: wetness.	Severe: low strength.
12----- Captina	Moderate: too clayey, wetness.	Moderate: wetness.	Severe: shrink-swell, wetness.	Moderate: slope, wetness.	Severe: low strength.
13----- Clarksville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
14----- Doniphan	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
15----- Doniphan	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
16----- Elsah	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
17*: Estate-----	Moderate: depth to rock, large stones, slope.	Moderate: slope, shrink-swell.	Moderate: depth to rock, slope, shrink-swell.	Severe: slope.	Severe: low strength.
Portia-----	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope.
Moko-----	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, large stones.
18*: Estate-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
Portia-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Moko-----	Severe: depth to rock, large stones, slope.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.
19----- Gassville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
20----- Healing	Slight-----	Slight-----	Slight-----	Slight-----	Severe: low strength.
21*: Moko-----	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, large stones.
Rock outcrop.					
22*: Moko-----	Severe: depth to rock, large stones, slope.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.
Rock outcrop.					
23----- Mountainburg	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
24----- Mountainburg	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, large stones.
25----- Mountainburg	Severe: depth to rock, large stones, slope.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
26----- Nixa	Slight-----	Slight-----	Slight-----	Moderate: slope.	Slight.
27----- Nixa	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
28*: Nixa-----	Slight-----	Slight-----	Slight-----	Moderate: slope.	Slight.
Doniphan-----	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
29*: Nixa-----	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Doniphan-----	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.
30*: Nixa-----	Slight-----	Slight-----	Slight-----	Moderate: slope.	Slight.
Noark-----	Moderate: too clayey.	Slight-----	Slight-----	Moderate: slope.	Slight.
31*: Nixa-----	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Noark-----	Moderate: too clayey, slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
32----- Noark	Moderate: too clayey.	Slight-----	Slight-----	Moderate: slope.	Slight.
33----- Noark	Moderate: too clayey, slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
34----- Noark	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
35----- Portia	Slight-----	Slight-----	Slight-----	Moderate: slope.	Moderate: low strength.
36----- Portia	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope.
37----- Razort	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
38----- Sidon	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Moderate: low strength, wetness.
39----- Tont1	Severe: wetness.	Moderate: wetness.	Severe: shrink-swell, wetness.	Moderate: slope, wetness.	Moderate: wetness.
40*: Udorthents.					

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
40*: Ramsey----- Rock outcrop.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.
41----- Ventriss	Severe: depth to rock. shrink-swell.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
42----- Wideman	Severe: floods, cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1----- Arkana	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
2*: Arkana-----	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Moko-----	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: area reclaim, thin layer.
3*: Arkana-----	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Moko-----	Severe: depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: area reclaim, thin layer.
4*: Arkana-----	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
Moko-----	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope.	Poor: area reclaim, slope, thin layer.
5, 6, 7----- Britwater	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----	Fair: small stones.
8----- Brockwell	Slight-----	Moderate: seepage, slope.	Slight-----	Slight-----	Good.
9----- Brockwell	Slight-----	Moderate: seepage, slope.	Slight-----	Slight-----	Fair: small stones.
10----- Brockwell	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: small stones, slope.
11, 12----- Captina	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
13----- Clarksville	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too clayey.	Severe: seepage, slope.	Poor: too clayey, small stones, slope.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
14----- Doniphan	Moderate: percs slowly.	Moderate: seepage, slope, large stones.	Severe: too clayey.	Slight-----	Poor: too clayey, hard to pack.
15----- Doniphan	Moderate: percs slowly, slope.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
16----- Elsah	Severe: floods.	Severe: seepage, floods, large stones.	Severe: floods, seepage, large stones.	Severe: floods, seepage.	Poor: seepage.
17*: Estate-----	Severe: percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: slope, depth to rock.	Poor: too clayey, hard to pack.
Portia-----	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Moko-----	Severe: depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: area reclaim, thin layer.
18*: Estate-----	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, depth to rock, too clayey.	Severe: slope.	Poor: slope, too clayey, hard to pack.
Portia-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Moko-----	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope.	Poor: area reclaim, slope, thin layer.
19----- Gassville	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
20----- Healing	Slight-----	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----	Fair: too clayey.
21*: Moko-----	Severe: depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: area reclaim, thin layer.
Rock outcrop.					
22*: Moko-----	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope.	Poor: area reclaim, slope, thin layer.
Rock outcrop.					

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
23----- Mountainburg	Severe: depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: seepage, depth to rock.	Poor: area reclaim, seepage, small stones.
24----- Mountainburg	Severe: depth to rock, large stones.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: area reclaim, large stones, thin layer.
25----- Mountainburg	Severe: depth to rock, slope, large stones.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, large stones, slope.
26----- Nixa	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight-----	Poor: small stones.
27----- Nixa	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Poor: small stones.
28*: Nixa-----	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight-----	Poor: small stones.
Doniphan-----	Moderate: percs slowly.	Moderate: seepage, slope, large stones.	Severe: too clayey.	Slight-----	Poor: too clayey, hard to pack.
29*: Nixa-----	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Poor: small stones.
Doniphan-----	Moderate: percs slowly, slope.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
30*: Nixa-----	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight-----	Poor: small stones.
Noark-----	Moderate: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight-----	Poor: too clayey, small stones.
31*: Nixa-----	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Poor: small stones.
Noark-----	Moderate: percs slowly, slope.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, small stones.
32----- Noark	Moderate: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight-----	Poor: too clayey, small stones.
33----- Noark	Moderate: percs slowly, slope.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, small stones.
34----- Noark	Severe: slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, small stones, slope.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
35----- Portia	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----	Fair: too clayey.
36----- Portia	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
37----- Razort	Severe: floods.	Severe: seepage, floods.	Severe: floods, seepage.	Severe: floods.	Fair: too clayey.
38----- Sidon	Severe: percs slowly, wetness.	Severe: wetness.	Severe: depth to rock.	Moderate: wetness, depth to rock.	Fair: area reclaim, too clayey.
39----- Tont1	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey, wetness.	Moderate: wetness.	Poor: hard to pack.
40*: Udorthents.					
Ramsay-----	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, small stones, slope.
Rock outcrop.					
41----- Ventr1s	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
42----- Wideman	Severe: floods.	Severe: floods, seepage.	Severe: seepage, floods.	Severe: floods, seepage.	Poor: seepage.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1----- Arkana	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, too clayey.
2*, 3*: Arkana-----	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, too clayey.
Moko-----	Poor: area reclaim, large stones, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones, thin layer.
4*: Arkana-----	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope, too clayey.
Moko-----	Poor: area reclaim, large stones, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones, slope.
5, 6, 7----- Britwater	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
8, 9, 10----- Brockwell	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
11, 12----- Captina	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
13----- Clarksville	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
14, 15----- Doniphan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, too clayey.
16----- Elsah	Poor: large stones.	Improbable: small stones, large stones.	Improbable: large stones.	Poor: large stones, area reclaim.
17*: Estate-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Portia-----	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Moko-----	Poor: area reclaim, large stones, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones, thin layer.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
18*: Estate-----	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Portia-----	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Moko-----	Poor: area reclaim, large stones, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones, slope.
19----- Gassville	Poor: low strength, slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
20----- Healing	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
21*: Moko-----	Poor: area reclaim, large stones, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones, thin layer.
Rock outcrop.				
22*: Moko-----	Poor: area reclaim, large stones, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones, slope.
Rock outcrop.				
23----- Mountainburg	Poor: thin layer, area reclaim.	Improbable: excess fines.	Improbable: thin layer.	Poor: small stones, area reclaim.
24----- Mountainburg	Poor: area reclaim, large stones, thin layer.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, large stones, thin layer.
25----- Mountainburg	Poor: area reclaim, large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, large stones, slope.
26, 27----- Nixa	Good-----	Improbable: small stones.	Probable-----	Poor: small stones, area reclaim.
28*, 29*: Nixa-----	Good-----	Improbable: small stones.	Probable-----	Poor: small stones, area reclaim.
Doniphan-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, too clayey.
30*, 31*: Nixa-----	Good-----	Improbable: small stones.	Probable-----	Poor: small stones, area reclaim.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
30*, 31*: Noark-----	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
32, 33----- Noark	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
34----- Noark	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
35----- Portia	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
36----- Portia	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
37----- Razort	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
38----- Sidon	Fair: thin layer, wetness, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
39----- Tontl	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
40*: Udorthents.				
Ramsey-----	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Rock outcrop.				
41----- Ventris	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, too clayey.
42----- Wideman	Good-----	Improbable: thin layer.	Improbable: too sandy.	Fair: too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
1----- Arkana	Moderate: depth to rock.	Severe: hard to pack.	Deep to water	Droughty, percs slowly, depth to rock.	Large stones, depth to rock.	Large stones, depth to rock.
2*: Arkana-----	Moderate: depth to rock.	Severe: hard to pack.	Deep to water	Droughty, percs slowly, depth to rock.	Large stones, depth to rock.	Large stones, depth to rock.
Moko-----	Severe: depth to rock.	Severe: large stones.	Deep to water	Large stones, droughty, depth to rock.	Large stones, depth to rock.	Large stones, droughty, depth to rock.
3*: Arkana-----	Moderate: depth to rock.	Severe: hard to pack.	Deep to water	Droughty, percs slowly, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
Moko-----	Severe: depth to rock.	Severe: large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
4*: Arkana-----	Severe: slope.	Severe: hard to pack.	Deep to water	Droughty, percs slowly, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
Moko-----	Severe: depth to rock, slope.	Severe: large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
5----- Britwater	Moderate: seepage.	Slight-----	Deep to water	Favorable-----	Favorable-----	Favorable.
6, 7----- Britwater	Moderate: seepage.	Slight-----	Deep to water	Slope-----	Favorable-----	Favorable.
8, 9----- Brockwell	Moderate: seepage.	Severe: piping.	Deep to water	Slope-----	Favorable-----	Favorable.
10----- Brockwell	Moderate: seepage.	Severe: piping.	Deep to water	Slope-----	Slope-----	Slope.
11----- Captina	Slight-----	Moderate: hard to pack, wetness.	Percs slowly---	Wetness, percs slowly, rooting depth.	Rooting depth, wetness, erodes easily.	Erodes easily, rooting depth, percs slowly.
12----- Captina	Slight-----	Moderate: hard to pack, wetness.	Percs slowly, slope.	Slope, percs slowly, rooting depth.	Rooting depth, wetness, erodes easily.	Erodes easily, rooting depth, percs slowly.
13----- Clarksville	Severe: seepage, slope.	Moderate: large stones.	Deep to water	Droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
14----- Doniphan	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Droughty, slope.	Favorable-----	Droughty.
15----- Doniphan	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Droughty, slope.	Slope-----	Slope, droughty.
16----- Elsah	Severe: seepage.	Severe: seepage, large stones.	Deep to water	Large stones, erodes easily.	Large stones, erodes easily.	Large stones, erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
17*: Estate-----	Slight-----	Moderate: hard to pack, thin layer, large stones.	Deep to water	Large stones, slope, percs slowly.	Large stones, slope, percs slowly.	Large stones, slope, percs slowly.
Portia-----	Slight-----	Moderate: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Moko-----	Severe: depth to rock.	Severe: large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
18*: Estate-----	Severe: slope.	Moderate: hard to pack, thin layer, large stones.	Deep to water	Large stones, slope, percs slowly.	Large stones, slope, percs slowly.	Large stones, slope, percs slowly.
Portia-----	Severe: slope.	Moderate: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Moko-----	Severe: depth to rock, slope.	Severe: large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
19----- Gassville	Severe: slope.	Severe: hard to pack.	Deep to water	Percs slowly, slope, erodes easily.	Slope, large stones, erodes easily.	Large stones, slope, erodes easily.
20----- Healing	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
21*: Moko-----	Severe: depth to rock.	Severe: large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Rock outcrop.						
22*: Moko-----	Severe: depth to rock, slope.	Severe: large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Rock outcrop.						
23----- Mountainburg	Severe: depth to rock, seepage.	Severe: thin layer, seepage.	Deep to water	Droughty, depth to rock, slope.	Large stones, depth to rock.	Large stones, droughty, depth to rock.
24----- Mountainburg	Severe: depth to rock, seepage.	Severe: large stones, thin layer.	Deep to water	Slope, large stones, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
25----- Mountainburg	Severe: depth to rock, slope, seepage.	Severe: large stones, thin layer.	Deep to water	Slope, large stones, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
26----- Nixa	Slight-----	Moderate: seepage, piping.	Deep to water	Droughty, percs slowly, erodes easily.	Large stones, erodes easily, rooting depth.	Erodes easily, droughty, rooting depth.
27----- Nixa	Slight-----	Moderate: seepage, piping.	Deep to water	Droughty, percs slowly, erodes easily.	Slope, erodes easily, rooting depth.	Slope, erodes easily, droughty.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
28*: Nixa-----	Slight-----	Moderate: seepage, piping.	Deep to water	Droughty, percs slowly, erodes easily.	Large stones, erodes easily, rooting depth.	Erodes easily, droughty, rooting depth.
Doniphan-----	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Droughty, slope.	Favorable-----	Droughty.
29*: Nixa-----	Slight-----	Moderate: seepage, piping.	Deep to water	Droughty, percs slowly, erodes easily.	Slope, erodes easily, rooting depth.	Slope, erodes easily, droughty.
Doniphan-----	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Droughty, slope.	Slope-----	Slope, droughty.
30*: Nixa-----	Slight-----	Moderate: seepage, piping.	Deep to water	Droughty, percs slowly, erodes easily.	Large stones, erodes easily, rooting depth.	Erodes easily, droughty, rooting depth.
Noark-----	Moderate: seepage.	Slight-----	Deep to water	Droughty, slope.	Favorable-----	Droughty.
31*: Nixa-----	Slight-----	Moderate: seepage, piping.	Deep to water	Droughty, percs slowly, erodes easily.	Slope, erodes easily, rooting depth.	Slope, erodes easily, droughty.
Noark-----	Moderate: seepage.	Slight-----	Deep to water	Droughty, slope.	Slope-----	Slope, droughty.
32----- Noark	Moderate: seepage.	Slight-----	Deep to water	Droughty, slope.	Favorable-----	Droughty.
33----- Noark	Moderate: seepage.	Slight-----	Deep to water	Droughty, slope.	Slope-----	Slope, droughty.
34----- Noark	Severe: slope.	Slight-----	Deep to water	Droughty, slope.	Slope-----	Slope, droughty.
35----- Portia	Moderate: seepage.	Moderate: piping.	Deep to water	Slope-----	Favorable-----	Favorable.
36----- Portia	Moderate: seepage.	Moderate: piping.	Deep to water	Slope-----	Slope-----	Slope.
37----- Razort	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily, floods.	Erodes easily	Erodes easily.
38----- Sidon	Moderate: depth to rock.	Moderate: thin layer.	Percs slowly, slope.	Slope, percs slowly, rooting depth.	Wetness, rooting depth, erodes easily.	Percs slowly, erodes easily.
39----- Tont1	Slight-----	Moderate: piping, wetness, large stones.	Percs slowly, slope.	Wetness, percs slowly, rooting depth.	Rooting depth, wetness, erodes easily.	Erodes easily, rooting depth, percs slowly.
40*: Udorthents.						
Ramsey-----	Severe: depth to rock.	Severe: piping, thin layer.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Rock outcrop.						

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
41----- Ventriss	Moderate: depth to rock.	Severe: hard to pack.	Deep to water	Percs slowly, depth to rock, slope.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
42----- Wideman	Severe: seepage.	Severe: piping, seepage.	Deep to water	Floods, fast intake.	Too sandy-----	Droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	<u>In</u>				<u>Pct</u>					<u>Pct</u>	
1----- Arkana	0-11	Very cherty silt loam.	SM, SC, SM-SC, GM	A-4, A-2, A-1, A-6	20-30	60-90	50-80	45-70	15-40	<25	NP-15
	11-15	Very cherty silty clay, very cherty clay.	GC, SC, CL, CH	A-2, A-7	15-30	60-90	45-80	40-70	25-55	40-65	20-35
	15-27	Clay, cherty clay	CH	A-7	0-10	70-90	70-85	65-85	60-80	51-80	31-50
	27-29	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
2*, 3*: Arkana-----	0-11	Very cherty silt loam.	SM, SC, SM-SC, GM	A-4, A-2, A-1, A-6	20-30	60-90	50-80	45-70	15-40	<25	NP-15
	11-15	Very cherty silty clay, very cherty clay.	GC, SC, CL, CH	A-2, A-7	15-30	60-90	45-80	40-70	25-55	40-65	20-35
	15-27	Clay, cherty clay	CH	A-7	0-10	70-90	70-85	65-85	60-80	51-80	31-50
	27-29	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Moko-----	0-12	Very stony silt loam.	ML, CL, CL-ML, SM-SC	A-4, A-6	35-75	65-90	50-72	45-70	40-60	16-38	3-15
	12-14	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
4*: Arkana-----	0-11	Very cherty silt loam.	SM, SC, SM-SC, GM	A-4, A-2, A-1, A-6	20-30	60-90	50-80	45-70	15-40	<25	NP-15
	11-15	Very cherty silty clay, very cherty clay.	GC, SC, CL, CH	A-2, A-7	15-30	60-90	45-80	40-70	25-55	40-65	20-35
	15-27	Clay, cherty clay	CH	A-7	0-10	70-90	70-85	65-85	60-80	51-80	31-50
	27-29	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Moko-----	0-9	Very stony silt loam.	ML, CL, CL-ML, SM-SC	A-4, A-6	35-75	65-90	50-72	45-70	40-60	16-38	3-15
	9-11	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
5, 6----- Britwater	0-14	Silt loam-----	ML, CL-ML	A-4	0	90-100	85-100	80-95	65-85	<25	NP-7
	14-63	Gravelly silty clay loam, gravelly clay loam, silty clay loam.	CL, GC, SC	A-2, A-6, A-4	0	60-95	55-95	45-80	30-65	25-40	8-18
	63-76	Very gravelly silty clay, very gravelly clay, very gravelly clay loam.	GC, GP-GC	A-2, A-6, A-7	0	30-75	25-70	20-55	15-40	35-55	15-30
7----- Britwater	0-14	Gravelly silt loam.	ML, CL, CL-ML	A-4	0	70-85	70-85	65-80	65-80	<30	NP-10
	14-63	Gravelly silty clay loam, gravelly clay loam, silty clay loam.	CL, GC, SC	A-2, A-6, A-4	0	60-95	55-95	45-80	30-65	25-40	8-18
	63-76	Very gravelly silty clay, very gravelly clay, very gravelly clay loam.	GC, GP-GC	A-2, A-6, A-7	0	30-75	25-70	20-55	15-40	35-55	15-30

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
8----- Brockwell	0-9	Sandy loam-----	SM, ML, CL-ML, SM-SC	A-4, A-2	0	95-100	75-100	60-95	30-60	<15	NP-5
	9-28	Fine sandy loam, sandy loam, sandy clay loam.	SM, ML, CL-ML, SM-SC	A-4, A-2	0	95-100	60-100	50-95	30-60	<15	NP-5
	28-72	Fine sandy loam, loam, sandy clay loam.	SM, SM-SC	A-4, A-2	0	85-100	55-90	40-75	25-45	<25	NP-7
9, 10----- Brockwell	0-9	Gravelly sandy loam.	SM, SM-SC	A-4, A-2, A-1	0	80-100	50-80	40-70	20-45	<15	NP-5
	9-28	Gravelly fine sandy loam, gravelly sandy loam, gravelly sandy clay loam.	SM, ML, CL-ML, SM-SC	A-4, A-2	0	95-100	60-80	50-75	30-60	<15	NP-5
	28-72	Gravelly fine sandy loam, gravelly sandy loam, gravelly sandy clay loam.	SM, SM-SC	A-4, A-2	0	85-100	55-80	40-75	25-45	<25	NP-7
11, 12----- Captina	0-8	Silt loam-----	ML, CL-ML	A-4	0	95-100	90-100	85-100	75-95	<25	NP-7
	8-24	Silt loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	95-100	90-100	85-100	80-90	20-40	5-20
	24-32	Cherty silty clay loam, cherty silt loam.	CL-ML, CL, SM-SC, SC	A-4, A-6	5-15	80-95	70-90	65-90	45-85	20-40	5-20
	32-44	Very cherty silty clay loam, very cherty silty clay.	CL, GC, SC	A-6, A-7	5-45	60-95	55-90	45-90	40-85	30-50	15-30
	44-72	Clay, silty clay, cherty clay.	CL, CH	A-6, A-7	0-10	90-100	85-95	80-95	75-90	30-55	15-30
13----- Clarksville	0-20	Very cherty silt loam.	GC, SC, SM-SC, GP-GC	A-2-4, A-2-6	5-20	30-70	10-60	5-50	5-35	20-40	5-15
	20-51	Very cherty silty clay loam, very cherty silty clay, very cherty silt loam	GC, SC, SP-SC, GP-GC	A-2-6, A-6	5-20	30-70	10-60	10-50	5-45	30-40	15-25
	51-72	Very cherty silty clay.	GC, SC, GP-GC, SP-SC	A-2-7, A-7	5-20	30-70	10-60	10-50	10-45	55-75	35-45
14, 15----- Doniphan	0-9	Very cherty silt loam.	CL-ML, GM, GM-GC, SM-SC	A-4	5-30	50-80	45-70	45-65	35-60	20-30	2-8
	9-17	Very cherty silty clay loam, very cherty silt loam	CL	A-6	5-30	85-100	85-100	70-85	50-70	30-40	15-25
	17-29	Cherty clay, cherty silty clay.	CH, MH	A-7	0-5	85-100	60-100	55-100	50-90	51-70	25-35
	29-78	Clay, silty clay.	CH	A-7	0-5	90-100	90-100	85-100	70-95	51-70	25-35
16----- Elsah	0-9	Cherty loam-----	CL-ML, CL	A-4, A-6	0-15	80-95	75-90	65-80	50-70	22-32	4-12
	9-72	Cherty loam, very cherty loam, very cherty silt loam.	SM, ML, GM, GM-GC	A-2, A-4	15-60	80-90	70-85	60-80	30-70	<30	NP-8
	72-74	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
17*: Estate-----	0-8	Stony sandy loam	SM	A-2, A-4	10-30	75-95	60-80	55-75	20-50	<20	NP-3
	8-13	Sandy loam, loam, sandy clay loam.	ML, CL-ML, SM, SM-SC	A-2, A-4	0-20	80-95	70-90	40-80	30-60	<25	NP-5
	13-36	Clay, sandy clay, clay loam.	CH, CL	A-6, A-7	0-15	80-95	80-95	70-90	55-80	35-55	15-30
	36-48	Clay, sandy clay loam, clay loam.	CL, SC	A-4, A-6	0-20	80-100	75-100	65-90	35-70	25-40	10-20
	48-50	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Portia-----	0-10	Fine sandy loam--	ML, CL-ML	A-4	0	100	85-100	75-95	65-85	<25	NP-7
	10-20	Loam, sandy clay loam.	CL, ML, CL-ML	A-4, A-6	0	100	85-100	75-95	65-80	18-30	3-12
	20-30	Clay loam, silty clay loam, sandy clay loam.	CL	A-4, A-6	0	100	85-100	80-95	65-85	25-40	8-20
	30-72	Sandy clay loam, clay loam, sandy clay.	CL, CH, SC	A-4, A-6, A-7	0	100	85-100	75-95	36-75	25-55	8-30
Moko-----	0-10	Very stony silt loam.	ML, CL, CL-ML, SM-SC	A-4, A-6	35-75	65-90	50-72	45-70	40-60	16-38	3-15
	10-12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
18*: Estate-----	0-8	Stony sandy loam	SM	A-2, A-4	10-30	75-95	60-80	55-75	20-50	<20	NP-3
	8-13	Sandy loam, clay loam, sandy clay loam.	ML, CL-ML, SM, SM-SC	A-2, A-4	0-20	80-95	70-90	40-80	30-60	<25	NP-5
	13-36	Clay, sandy clay, clay loam.	CH, CL	A-6, A-7	0-15	80-95	80-95	70-90	55-80	35-55	15-30
	36-48	Clay, sandy clay loam, clay loam.	CL, SC	A-4, A-6	0-20	80-100	75-100	65-90	35-70	25-40	10-20
	48-50	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Portia-----	0-10	Loam-----	ML, CL-ML	A-4	0	100	85-100	75-95	65-85	<25	NP-7
	10-20	Loam, silt loam, sandy clay loam.	CL, ML, CL-ML	A-4, A-6	0	100	85-100	75-95	65-80	18-30	3-12
	20-30	Clay loam, silty clay loam, sandy clay loam.	CL	A-4, A-6	0	100	85-100	80-95	65-85	25-40	8-20
	30-72	Sandy clay, sandy clay loam, clay loam.	CL, CH, SC	A-4, A-6, A-7	0	100	85-100	75-95	36-75	25-55	8-30
Moko-----	0-9	Very stony silt loam.	ML, CL, CL-ML, SM-SC	A-4, A-6	35-75	65-90	50-72	45-70	40-60	16-38	3-15
	9-11	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
19----- Gassville	0-10	Very cherty silt loam.	GM, GM-GC, GP-GM	A-1, A-2	10-30	25-40	20-40	15-35	10-30	<25	NP-5
	10-19	Cherty clay-----	CH	A-7	2-10	70-80	70-80	65-75	55-70	55-80	27-47
	19-38	Clay-----	CH	A-7	2-10	85-95	70-95	65-90	60-85	55-80	27-47
	38-55	Weathered bedrock	---	---	---	---	---	---	---	---	---
	55-57	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
20----- Healing	0-13	Silt loam-----	ML, CL-ML	A-4	0	90-100	90-100	90-100	80-95	<30	NP-7
	13-48	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	90-100	90-100	90-100	85-95	20-35	5-15
	48-80	Silt loam, silty clay loam, gravelly silt loam.	GC, ML, CL, SC	A-4, A-6, A-2	0	60-100	50-100	35-85	25-80	27-40	4-17

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches Pct	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
21#: Moko-----	<u>In</u>										
	0-12	Very stony silt loam.	ML, CL, CL-ML, SM-SC	A-4, A-6	35-75	65-90	50-72	45-70	40-60	16-38	3-15
	12-14	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
22#: Moko-----											
	0-6	Very stony silt loam.	ML, CL, CL-ML, SM-SC	A-4, A-6	35-75	65-90	50-72	45-70	40-60	16-38	3-15
	6-8	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
23----- Mountainburg	0-9	Gravelly loam----	GM, SM	A-1, A-2	0-15	60-80	50-70	20-40	15-30	---	NP
	9-18	Very gravelly sandy clay loam, very gravelly sandy loam, very gravelly loam.	GM, GC, GP-GM, GM-GC	A-1, A-2	15-30	40-60	30-50	25-50	10-25	<30	NP-10
	18-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
24----- Mountainburg	0-6	Very stony sandy loam.	GM	A-1, A-2	30-65	40-50	30-50	20-40	15-25	<20	NP
	6-18	Very gravelly sandy clay loam, very stony loam, very stony fine sandy loam.	GM, GC, GM-GC	A-1, A-2	30-65	40-60	30-50	25-50	20-30	<30	NP-10
	18-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
25----- Mountainburg	0-6	Very stony fine sandy loam.	GM	A-1, A-2	30-65	40-50	30-50	20-40	15-25	<20	NP
	6-18	Very gravelly sandy clay loam, very stony loam, very stony fine sandy loam.	GM, GC, GM-GC	A-1, A-2	30-65	40-60	30-50	25-50	20-30	<30	NP-10
	18-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
26, 27----- Nixa	0-11	Very cherty silt loam.	GM, SM, GC, SC	A-1, A-2, A-4	0-10	40-70	30-60	25-55	20-50	<25	NP-8
	11-22	Very cherty silt loam, very cherty silty clay loam.	GC, GM, SC, SM	A-1, A-2, A-4	0-10	40-70	30-60	25-55	20-50	<30	NP-8
	22-44	Very cherty silt loam, very cherty silty clay loam.	GC, GM, SC, SM	A-1, A-2, A-4	0-10	40-70	30-60	25-55	20-50	<30	NP-8
	44-72	Very cherty silty clay, very cherty silty clay loam.	GM, GC, GP-GM	A-1, A-2	10-30	15-45	5-40	5-35	5-30	<30	NP-8

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	<u>In</u>				<u>Pct</u>					<u>Pct</u>	
28*, 29*: Nixa-----	0-11	Very cherty silt loam.	GM, SM, GC, SC	A-1, A-2, A-4	0-10	40-70	30-60	25-55	20-50	<25	NP-8
	11-22	Very cherty silt loam, very cherty silty clay loam.	GC, GM, SC, SM	A-1, A-2, A-4	0-10	40-70	30-60	25-55	20-50	<30	NP-8
	22-44	Very cherty silt loam, very cherty silty clay loam.	GC, GM, SC, SM	A-1, A-2, A-4	0-10	40-70	30-60	25-55	20-50	<30	NP-8
	44-72	Very cherty silty clay, very cherty silty clay loam.	GM, GC, GP-GM	A-1, A-2	10-30	15-45	5-40	5-35	5-30	<30	NP-8
Doniphan-----	0-9	Very cherty silt loam.	CL-ML, GM, GM-GC, SM-SC	A-4	5-30	50-80	45-70	45-65	35-60	20-30	2-8
	9-17	Very cherty silty clay loam, very cherty silt loam	CL	A-6	5-30	85-100	85-100	70-85	50-70	30-40	15-25
	17-29	Cherty clay, cherty silty clay, clay.	CH, MH	A-7	0-5	85-100	60-100	55-100	50-90	51-70	25-35
	29-78	Clay, silty clay	CH	A-7	0-5	90-100	90-100	85-100	70-95	51-70	25-35
30*, 31*: Nixa-----	0-11	Very cherty silt loam.	GM, SM, GC, SC	A-1, A-2, A-4	0-10	40-70	30-60	25-55	20-50	<25	NP-8
	11-22	Very cherty silt loam, very cherty silty clay loam.	GC, GM, SC, SM	A-1, A-2, A-4	0-10	40-70	30-60	25-55	20-50	<30	NP-8
	22-44	Very cherty silt loam, very cherty silty clay loam.	GC, GM, SC, SM	A-1, A-2, A-4	0-10	40-70	30-60	25-55	20-50	<30	NP-8
	44-72	Very cherty silty clay, very cherty silty clay loam.	GM, GC, GP-GM	A-1, A-2	10-30	15-45	5-40	5-35	5-30	<30	NP-8
Noark-----	0-18	Very cherty silt loam.	GM	A-2, A-1, A-4	0	20-50	20-50	20-50	15-45	<20	NP-3
	18-24	Very cherty silt loam, very cherty silty clay loam.	GC, GM-GC	A-2, A-4, A-6, A-1	0	20-50	20-50	20-50	15-45	20-35	5-15
	24-72	Very cherty clay, very cherty silty clay.	GC	A-2, A-7	5-10	20-50	20-50	20-50	15-45	41-60	20-35
32, 33----- Noark	0-18	Very cherty silt loam.	GM	A-2, A-1, A-4	0	20-50	20-50	20-50	15-45	<20	NP-3
	18-24	Very cherty silt loam, very cherty silty clay loam.	GC, GM-GC	A-2, A-4, A-6, A-1	0	20-50	20-50	20-50	15-45	20-35	5-15
	24-72	Very cherty clay, very cherty silty clay.	GC	A-2, A-7	5-10	20-50	20-50	20-50	15-45	41-60	20-35

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	<u>In</u>				<u>Pct</u>						
34----- Noark	0-14	Very cherty silt loam.	GM	A-2, A-1, A-4	0	20-50	20-50	20-50	15-45	<20	NP-3
	14-24	Very cherty silt loam, very cherty silty clay loam.	GC, GM-GC	A-2, A-4, A-6, A-1	0	20-50	20-50	20-50	15-45	20-35	5-15
	24-72	Very cherty clay, very cherty silty clay.	GC	A-2, A-7	5-10	20-50	20-50	20-50	15-45	41-60	20-35
35, 36----- Portia	0-10	Fine sandy loam	SM, ML	A-2, A-4	0	100	85-100	70-85	35-60	---	NP
	10-20	Loam, sandy clay loam.	CL, ML, CL-ML	A-4, A-6	0	100	85-100	75-95	65-80	18-30	3-12
	20-30	Clay loam, silty clay loam, sandy clay loam.	CL	A-4, A-6	0	100	85-100	80-95	65-85	25-40	8-20
	30-72	Sandy clay, sandy clay loam, clay loam.	CL, CH, SC	A-4, A-6, A-7	0	100	85-100	75-95	36-75	25-55	8-30
37----- Razort	0-10	Silt loam-----	ML, CL-ML	A-4	0	80-100	75-100	65-90	65-90	<25	NP-7
	10-58	Silty clay loam, loam, gravelly loam.	CL, CL-ML	A-4, A-6	0	75-100	65-100	75-85	70-80	25-40	7-15
	58-85	Gravelly silt loam, very gravelly silt loam.	GM, SM, ML, CL-ML	A-2, A-4, A-1	0	35-75	30-70	25-65	20-60	<20	NP-7
38----- Sidon	0-7	Silt loam-----	ML, CL-ML, CL	A-4	0	100	95-100	75-90	65-85	15-25	2-10
	7-21	Silty clay loam, silt loam, loam.	CL-ML, CL	A-4, A-6	0	100	95-100	75-90	60-75	20-30	5-15
	21-44	Clay loam, silt loam, gravelly clay loam.	CL, SC	A-4, A-6	0	95-100	50-100	40-85	35-70	20-35	8-15
	44-58	Clay loam, loam, gravelly clay loam.	CL, SC	A-2, A-4, A-6	0-5	80-100	45-100	35-85	25-60	20-30	8-15
	58-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
39----- Tonti	0-7	Cherty silt loam	ML	A-4	0-5	75-95	70-90	65-85	60-70	<20	NP-3
	7-19	Cherty silty clay loam, cherty silt loam.	CL-ML, CL	A-4, A-6	0-5	70-90	65-85	60-80	55-75	15-30	5-15
	19-32	Very cherty silty clay loam, very cherty silt loam.	CL-ML, CL, SM-SC, SC	A-4, A-6	5-35	50-75	45-70	40-65	40-60	15-30	5-15
	32-72	Silty clay, clay, cherty clay.	CL, CH	A-6, A-7	0-10	90-100	80-95	75-90	70-85	30-55	15-30
40*: Udorthents.											
Ramsey-----	0-13	Stony sandy loam	SM, SC, ML, CL	A-4, A-2	15-30	75-90	65-85	50-75	34-65	15-25	2-8
	13-15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
41----- Ventris	0-5	Cherty silt loam	ML, CL, GM, GC	A-4, A-6	3-6	50-85	45-80	40-70	36-65	<35	NP-15
	5-32	Clay, cherty clay	CH	A-7-6	0	70-95	70-95	65-95	60-90	50-80	35-55
	32-34	Weathered bedrock	---	---	---	---	---	---	---	---	---
	34-36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
42----- Wideman	0-6	Sandy loam-----	SM, ML	A-2, A-4	0	100	100	65-90	30-60	<20	NP-3
	6-21	Loamy sand, sandy loam, loamy fine sand.	SP-SM, SM	A-2	0	100	100	60-80	10-35	---	NP
	21-52	Fine sandy loam, silt loam, loamy sand.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	100	75-100	65-95	30-75	<25	NP-5
	52-80	Loamy sand, loamy fine sand, sand.	SM, SP-SM	A-2	0	100	70-100	50-75	10-35	---	NP

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors	
						K	T
	<u>In</u>	<u>In/hr</u>	<u>In/in</u>	<u>pH</u>			
1----- Arkana	0-11 11-15 15-27 27-29	0.6-2.0 0.06-0.2 <0.06 ---	0.08-0.12 0.06-0.10 0.12-0.18 ---	5.6-7.8 5.1-8.4 5.1-8.4 ---	Low----- Moderate----- High----- -----	0.28 0.24 0.32 ---	2
2*, 3*: Arkana-----	0-11 11-15 15-27 27-29	0.6-2.0 0.06-0.2 <0.06 ---	0.08-0.12 0.06-0.10 0.12-0.18 ---	5.6-7.8 5.1-8.4 5.1-8.4 ---	Low----- Moderate----- High----- -----	0.28 0.24 0.32 ---	2
Moko-----	0-12 12-14	0.6-2.0 ---	0.09-0.14 ---	6.6-7.8 ---	Low----- -----	0.32 ---	1
4*: Arkana-----	0-11 11-15 15-27 27-29	0.6-2.0 0.06-0.2 <0.06 ---	0.08-0.12 0.06-0.10 0.12-0.18 ---	5.6-7.8 5.1-8.4 5.1-8.4 ---	Low----- Moderate----- High----- -----	0.28 0.24 0.32 ---	2
Moko-----	0-9 9-11	0.6-2.0 ---	0.09-0.14 ---	6.6-7.8 ---	Low----- -----	0.32 ---	1
5, 6----- Britwater	0-14 14-63 63-76	0.6-2.0 0.6-2.0 0.6-2.0	0.15-0.24 0.12-0.15 0.07-0.09	5.1-6.0 5.1-6.0 5.1-6.0	Low----- Low----- Moderate-----	0.32 0.28 0.24	3
7----- Britwater	0-14 14-63 63-76	0.6-2.0 0.6-2.0 0.6-2.0	0.12-0.20 0.12-0.15 0.07-0.09	5.1-6.0 5.1-6.0 5.1-6.0	Low----- Low----- Moderate-----	0.32 0.28 0.24	3
8----- Brockwell	0-9 9-28 28-72	0.6-2.0 0.6-2.0 0.6-2.0	0.10-0.20 0.12-0.20 0.12-0.18	4.5-6.0 4.5-6.0 4.5-6.0	Low----- Low----- Low-----	0.28 0.28 0.24	5
9, 10----- Brockwell	0-9 9-28 28-72	2.0-6.0 0.6-2.0 0.6-2.0	0.08-0.16 0.12-0.20 0.12-0.18	4.5-6.0 4.5-6.0 4.5-6.0	Low----- Low----- Low-----	0.24 0.28 0.24	5
11, 12----- Captina	0-8 8-24 24-32 32-44 44-72	0.6-2.0 0.6-2.0 0.06-0.2 0.06-0.2 0.06-0.2	0.16-0.24 0.16-0.24 0.04-0.08 0.02-0.08 0.05-0.10	5.1-6.5 5.1-6.5 3.6-5.5 3.6-5.5 3.6-5.5	Low----- Low----- Low----- High----- High-----	0.43 0.37 0.32 0.32 0.32	4
13----- Clarksville	0-20 20-51 51-72	2.0-6.0 2.0-6.0 2.0-6.0	0.07-0.12 0.06-0.10 0.05-0.08	4.5-6.0 4.5-5.5 4.5-5.5	Low----- Low----- Low-----	0.28 0.28 0.28	2
14, 15----- Doniphan	0-9 9-17 17-29 29-78	2.0-6.0 0.6-2.0 0.6-2.0 0.6-2.0	0.08-0.15 0.10-0.14 0.08-0.10 0.08-0.10	4.5-6.5 3.6-5.5 3.6-5.5 3.6-5.5	Low----- Moderate----- Moderate----- Moderate-----	0.28 0.28 0.28 0.28	2
16----- Elsah	0-9 9-72 72-74	0.6-2.0 2.0-6.0 ---	0.17-0.24 0.10-0.15 ---	5.6-7.3 5.6-7.3 ---	Low----- Low----- ---	0.37 0.17 ---	3
17*: Estate-----	0-8 8-13 13-36 36-48 48-50	0.6-6.0 0.6-2.0 0.06-0.2 0.2-0.6 ---	0.07-0.15 0.10-0.18 0.12-0.18 0.10-0.18 ---	5.1-7.3 5.6-7.3 5.6-7.3 5.6-7.3 ---	Low----- Low----- Moderate----- Moderate----- -----	0.28 0.32 0.28 0.28 ---	3

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors	
						K	T
	In	In/hr	In/in	pH			
17*: Portia-----	0-10	0.6-2.0	0.15-0.24	5.1-6.5	Low-----	0.37	3
	10-20	0.6-2.0	0.15-0.24	4.5-6.0	Low-----	0.32	
	20-30	0.2-2.0	0.10-0.17	4.5-6.0	Low-----	0.32	
	30-72	0.2-2.0	0.12-0.20	5.1-6.0	Moderate-----	0.32	
Moko-----	0-10	0.6-2.0	0.09-0.14	6.6-7.8	Low-----	0.32	1
	10-12	---	---	---	---	---	
18*: Estate-----	0-8	0.6-6.0	0.07-0.15	5.1-7.3	Low-----	0.28	3
	8-13	0.6-2.0	0.10-0.18	5.6-7.3	Low-----	0.32	
	13-36	0.06-0.2	0.12-0.18	5.6-7.3	Moderate-----	0.28	
	36-48	0.2-0.6	0.10-0.18	5.6-7.3	Moderate-----	0.28	
	48-50	---	---	---	---	---	
Portia-----	0-10	0.6-2.0	0.15-0.24	5.1-6.5	Low-----	0.37	3
	10-20	0.6-2.0	0.15-0.24	4.5-6.0	Low-----	0.32	
	20-30	0.2-2.0	0.10-0.17	4.5-6.0	Low-----	0.32	
	30-72	0.2-2.0	0.12-0.20	5.1-6.0	Moderate-----	0.28	
Moko-----	0-9	0.6-2.0	0.09-0.14	6.6-7.8	Low-----	0.32	1
	9-11	---	---	---	---	---	
19----- Gassville	0-10	2.0-6.0	0.06-0.10	5.1-6.5	Low-----	0.37	3
	10-19	<0.06	0.10-0.16	4.5-5.5	Moderate-----	0.32	
	19-38	<0.06	0.12-0.18	4.5-5.5	Moderate-----	0.37	
	38-55	---	---	---	---	---	
	55-57	---	---	---	---	---	
20----- Healing	0-13	0.6-2.0	0.16-0.24	5.6-6.5	Low-----	0.37	5
	13-48	0.6-2.0	0.16-0.24	5.6-6.5	Low-----	0.37	
	48-80	0.6-2.0	0.13-0.19	5.6-6.5	Low-----	0.37	
21*: Moko-----	0-12	0.6-2.0	0.09-0.14	6.6-7.8	Low-----	0.32	1
	12-14	---	---	---	---	---	
Rock outcrop.							
22*: Moko-----	0-6	0.6-2.0	0.09-0.14	6.6-7.8	Low-----	0.32	1
	6-8	---	---	---	---	---	
Rock outcrop.							
23----- Mountainburg	0-9	2.0-6.0	0.05-0.10	5.1-6.0	Low-----	0.20	1
	9-18	2.0-6.0	0.05-0.10	4.5-5.5	Low-----	0.17	
	18-20	---	---	---	---	---	
24, 25----- Mountainburg	0-6	2.0-6.0	0.05-0.10	5.1-6.0	Low-----	0.17	1
	6-18	2.0-6.0	0.05-0.10	4.5-5.5	Low-----	0.24	
	18-20	---	---	---	---	---	
26, 27----- Nixa	0-11	0.6-2.0	0.08-0.10	4.5-5.5	Low-----	0.43	2
	11-22	0.2-0.6	0.08-0.10	4.5-5.5	Low-----	0.43	
	22-44	<0.06	0.05-0.08	4.5-5.5	Low-----	0.43	
	44-72	<0.06	0.03-0.06	4.5-5.5	Low-----	0.37	
28*, 29*: Nixa-----	0-11	0.6-2.0	0.08-0.10	4.5-5.5	Low-----	0.43	2
	11-22	0.2-0.6	0.08-0.10	4.5-5.5	Low-----	0.43	
	22-44	<0.06	0.05-0.08	4.5-5.5	Low-----	0.43	
	44-72	<0.06	0.03-0.06	4.5-5.5	Low-----	0.37	
Doniphan-----	0-9	2.0-6.0	0.08-0.15	4.5-6.5	Low-----	0.28	2
	9-17	0.6-2.0	0.10-0.14	3.6-5.5	Moderate-----	0.28	
	17-29	0.6-2.0	0.08-0.10	3.6-5.5	Moderate-----	0.28	
	29-78	0.6-2.0	0.08-0.10	3.6-5.5	Moderate-----	0.28	

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors	
						K	T
	In	In/hr	In/in	pH			
30*, 31*: Nixa-----	0-11	0.6-2.0	0.08-0.10	4.5-5.5	Low-----	0.43	2
	11-22	0.2-0.6	0.08-0.10	4.5-5.5	Low-----	0.43	
	22-44	<0.06	0.05-0.08	4.5-5.5	Low-----	0.43	
	44-72	<0.06	0.03-0.06	4.5-5.5	Low-----	0.37	
Noark-----	0-18	0.6-2.0	0.10-0.14	4.5-6.5	Low-----	0.32	3
	18-24	0.6-2.0	0.10-0.14	3.6-5.5	Low-----	0.28	
	24-72	0.6-2.0	0.09-0.13	3.6-5.5	Low-----	0.24	
32, 33-----	0-18	0.6-2.0	0.10-0.14	4.5-6.5	Low-----	0.32	3
Noark	18-24	0.6-2.0	0.10-0.14	3.6-5.5	Low-----	0.28	
	24-72	0.6-2.0	0.09-0.13	3.6-5.5	Low-----	0.24	
34-----	0-14	0.6-2.0	0.10-0.14	4.5-6.5	Low-----	0.32	3
Noark	14-24	0.6-2.0	0.10-0.14	3.6-5.5	Low-----	0.28	
	24-72	0.6-2.0	0.09-0.13	3.6-5.5	Low-----	0.24	
35, 36-----	0-10	0.6-2.0	0.11-0.15	5.1-6.5	Low-----	0.24	3
Portia	10-20	0.6-2.0	0.15-0.24	4.5-6.0	Low-----	0.32	
	20-30	0.2-0.6	0.10-0.17	4.5-6.0	Low-----	0.32	
	30-72	0.2-2.0	0.12-0.20	5.1-6.0	Moderate-----	0.28	
37-----	0-10	0.6-2.0	0.10-0.22	6.1-7.3	Low-----	0.37	5
Razort	10-58	0.6-2.0	0.13-0.22	5.6-6.5	Low-----	0.37	
	58-85	2.0-6.0	0.08-0.12	5.6-6.5	Low-----	0.32	
38-----	0-7	0.6-2.0	0.13-0.24	3.6-5.5	Low-----	0.43	3
Sidon	7-21	0.6-2.0	0.15-0.24	3.6-5.5	Low-----	0.43	
	21-44	0.06-0.6	0.08-0.15	3.6-5.5	Low-----	0.37	
	44-58	0.06-0.6	0.12-0.20	3.6-5.5	Low-----	0.32	
	58-60	---	---	---	---	---	
39-----	0-7	0.6-2.0	0.15-0.20	4.5-5.5	Low-----	0.37	4
Tonti	7-19	0.6-2.0	0.12-0.18	4.5-5.5	Low-----	0.32	
	19-32	0.06-0.2	0.02-0.08	4.5-5.5	Low-----	0.28	
	32-72	0.06-0.2	0.05-0.10	4.5-5.5	High-----	0.32	
40*: Udorthents.							
Ramsey-----	0-13	6.0-20	0.06-0.10	4.5-5.5	Low-----	0.17	1
	13-15	---	---	---	---	---	
Rock outcrop.							
41-----	0-5	0.6-2.0	0.12-0.20	5.6-7.3	Low-----	0.43	2
Ventris	5-32	<0.06	0.10-0.18	6.1-7.8	High-----	0.37	
	32-34	---	---	---	---	---	
	34-46	---	---	---	---	---	
42-----	0-6	2.0-6.0	0.07-0.15	3.6-6.0	Low-----	0.17	5
Wideman	6-21	>6.0	0.06-0.14	5.1-7.3	Low-----	0.17	
	21-52	2.0-6.0	0.06-0.20	5.1-7.3	Low-----	0.20	
	52-80	>6.0	0.05-0.11	5.1-7.3	Low-----	0.17	

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "frequent," "very brief," and "perched" are explained in the text.
The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydro- logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth Ft	Kind	Months	Depth In	Hard- ness	Uncoated steel	Concrete
1----- Arkana	C	None-----	---	---	>6.0	---	---	20-40	Hard	High-----	Moderate.
2*, 3*, 4*: Arkana-----	C	None-----	---	---	>6.0	---	---	20-40	Hard	High-----	Moderate.
Moko-----	D	None-----	---	---	>6.0	---	---	6-20	Hard	Low-----	Low.
5, 6, 7----- Britwater	B	None-----	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
8, 9, 10----- Brockwell	B	None-----	---	---	>6.0	---	---	>60	---	Low-----	Moderate.
11, 12----- Captina	C	None-----	---	---	2.0-3.0	Perched	Dec-Apr	>60	---	High-----	High.
13----- Clarksville	B	None-----	---	---	>6.0	---	---	>60	---	Low-----	High.
14, 15----- Doniphan	B	None-----	---	---	>6.0	---	---	>60	---	Moderate	High.
16----- Elsah	B	Frequent-----	Very brief	Dec-May	>6.0	---	---	>60	---	Low-----	Moderate.
17*, 18*: Estate-----	C	None-----	---	---	>6.0	---	---	40-60	Hard	Moderate	Moderate.
Portia-----	C	None-----	---	---	>6.0	---	---	>60	---	High-----	High.
Moko-----	D	None-----	---	---	>6.0	---	---	6-20	Hard	Low-----	Low.
19----- Gassville	C	None-----	---	---	>6.0	---	---	40-60	Hard	High-----	Moderate.
20----- Healing	B	None-----	---	---	>6.0	---	---	>60	---	Low-----	Moderate.
21*, 22*: Moko-----	D	None-----	---	---	>6.0	---	---	6-20	Hard	Low-----	Low.
Rock outcrop.											
23----- Mountainburg	D	None-----	---	---	>6.0	---	---	12-20	Hard	Low-----	High.
24, 25----- Mountainburg	D	None-----	---	---	>6.0	---	---	12-20	Hard	Low-----	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth Ft	Kind	Months	Depth In	Hard-ness	Uncoated steel	Concrete
26, 27----- Nixa	C	None-----	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
28*, 29*: Nixa-----	C	None-----	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
Doniphan-----	B	None-----	---	---	>6.0	---	---	>60	---	Moderate	High.
30*, 31*: Nixa-----	C	None-----	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
Noark-----	B	None-----	---	---	>6.0	---	---	>60	---	Moderate	High.
32, 33, 34----- Noark	B	None-----	---	---	>6.0	---	---	>60	---	Moderate	High.
35, 36----- Portia	C	None-----	---	---	>6.0	---	---	>60	---	High-----	High.
37----- Razort	B	Frequent----	Very brief	Jan-Apr	>6.0	---	---	>60	---	Low-----	Low.
38----- Sidon	C	None-----	---	---	2.0-3.0	Perched	Dec-Apr	40-60	Hard	Moderate	Moderate.
39----- Tonti	C	None-----	---	---	1.5-2.5	Perched	Dec-Apr	>60	---	---	---
40*: Udorthents.											
Ramsey-----	D	None-----	---	---	>6.0	---	---	7-20	Hard	Low-----	Moderate.
Rock outcrop.											
41----- Ventriss	D	None-----	---	---	>6.0	---	---	24-40	Hard	High-----	Low.
42----- Wideman	A	Frequent----	Very brief	Mar-May	>6.0	---	---	>60	---	Low-----	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--PHYSICAL ANALYSES OF SELECTED SOILS

Soil and sample number	Depth	Horizon	Particle-size distribution					
			Very coarse sand through medium sand (2.0-0.25 mm.)	Fine sand (0.25-0.10 mm.)	Very fine sand (0.10-0.05 mm.)	Total sand (2.0-0.05 mm.)	Silt (0.05-0.002 mm.)	Clay (<0.002 mm.)
	Inches		Percent less than 2.0 mm.					
Brockwell sandy loam: S76AR005-1(1-8)	0-5	A1	41.9	24.7	3.1	69.7	26.6	3.7
	5-9	A2	33.6	29.0	3.1	65.7	29.4	4.9
	9-13	B1	32.6	26.3	2.9	61.8	28.4	9.8
	13-21	B21t	24.1	29.7	2.6	56.4	28.8	14.8
	21-28	B21t	25.1	28.6	2.9	56.6	28.1	15.3
	28-44	B22t	32.0	24.2	2.9	59.1	29.0	11.9
	44-60	B23t	33.9	22.9	2.9	59.7	27.6	12.7
	60-72	B24t	32.3	27.4	2.5	62.2	13.3	24.5
Estate stony sandy loam: S78AR0089-2(1-6)	0-3	A1	46.2	20.9	3.8	70.9	24.3	4.8
	3-8	A2	50.1	19.3	4.1	73.5	20.9	5.6
	8-13	B1	36.5	16.3	3.5	56.3	25.1	18.6
	13-20	B21t	29.0	8.8	2.7	40.5	22.8	36.7
	20-36	B22t	32.3	8.4	1.9	42.6	20.2	37.2
	36-48	B23t	25.9	5.2	1.7	32.8	12.2	55.0
Nixa very cherty silt loam: S74AR089-2(1-6)	0-2	A1	16.3	8.4	4.0	28.7	64.3	7.0
	2-11	A2	13.1	8.4	3.2	24.7	65.3	10.0
	11-22	B1	15.8	6.5	2.9	25.2	56.3	18.5
	22-44	Bx	17.9	6.0	3.1	27.0	52.6	20.4
	44-60	B2t	9.0	4.4	2.5	15.9	47.5	36.6
	60-72	B2t	10.5	6.4	3.3	20.2	45.2	34.6

TABLE 19.--CHEMICAL ANALYSES OF SELECTED SOILS

Soil and sample number	Depth	Horizon	Extractable bases				Extractable acidity	Base saturation	Reaction (1:1 soil: water)	Organic matter
			Ca	Mg	Na	K				
	Inches		Milliequivalents per 100 grams of soil					Percent	pH	Percent
Brockwell sandy loam: S76AR005-1(1-8)	0-5	A1	0.6	0.1	0.0	0.1	4.2	16	4.7	1.0
	5-9	A2	0.5	0.1	0.0	0.1	3.1	18	4.7	0.5
	9-13	B1	0.8	0.4	0.0	0.1	4.3	23	4.6	0.3
	13-21	B21t	0.5	0.5	0.0	0.2	7.2	14	4.4	0.2
	21-28	B21t	0.2	0.8	0.0	0.2	8.5	12	4.4	0.2
	28-44	B22t	0.1	0.7	0.0	0.1	7.7	10	4.3	0.1
	44-60	B23t	0.1	0.7	0.0	0.1	7.6	11	4.5	0.1
	60-72	B24t	0.1	1.3	0.0	0.1	12.5	11	4.5	0.1
Estate stony sandy loam: S78AR005-1(1-6)	0-3	A1	3.0	0.8	0.0	0.2	3.8	51	5.9	1.6
	3-8	A2	1.2	0.5	0.0	0.1	3.9	32	5.2	0.6
	8-13	B1	3.5	1.9	0.0	0.2	6.0	48	5.2	0.7
	13-20	B21t	7.7	4.4	0.0	0.4	9.0	58	5.1	0.7
	20-36	B22t	9.1	5.8	0.0	0.4	9.1	63	5.2	0.5
	36-48	B23t	10.2	7.8	0.1	0.4	8.6	68	5.2	0.5
Nixa very cherty silt loam: S74AR089-2(1-6)	0-2	A1	4.2	0.7	0.2	0.2	9.2	37	5.9	2.9
	2-11	A2	0.5	0.4	0.2	0.1	8.0	13	4.7	0.9
	11-22	B1	0.7	0.5	0.2	0.1	9.0	14	4.7	0.3
	22-44	Bx	0.7	0.5	0.2	0.1	12.4	11	4.5	0.2
	44-60	B2t	0.7	0.4	0.2	0.1	15.5	8	4.4	0.2
	60-72	B2t	0.5	0.4	0.2	0.1	14.5	8	4.2	0.1

TABLE 20.--CLASSIFICATION OF THE SOILS

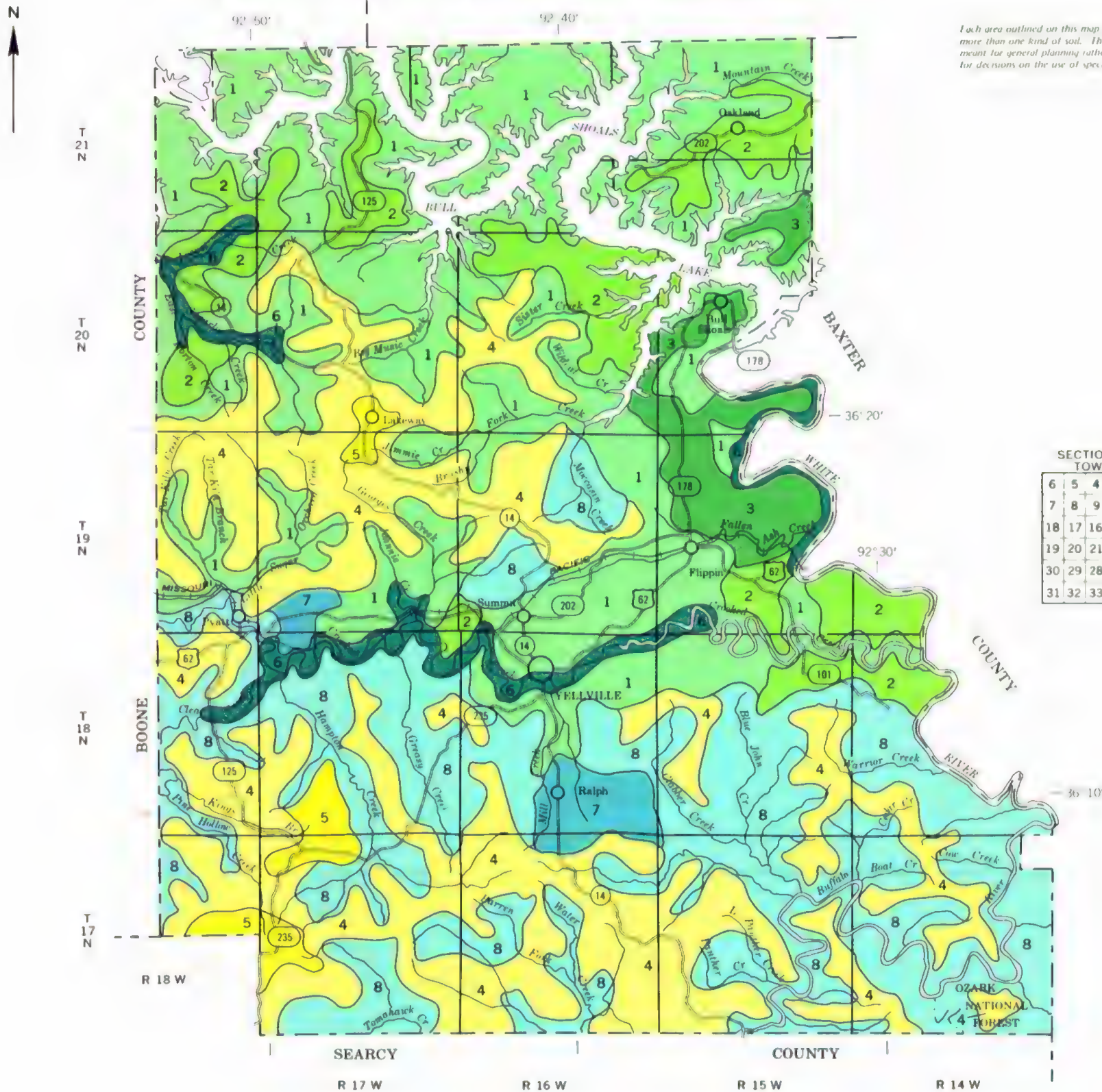
Soil name	Family or higher taxonomic class
Arkana-----	Very-fine, mixed, mesic Mollic Hapludalfs
Britwater-----	Fine-loamy, mixed, mesic Typic Paleudalfs
Brockwell-----	Coarse-loamy, siliceous, mesic Typic Paleudults
Captina-----	Fine-silty, mixed, mesic Typic Fragiudults
Clarksville-----	Loamy-skeletal, siliceous, mesic Typic Paleudults
Doniphan-----	Clayey, mixed, mesic Typic Paleudults
Elsah-----	Loamy-skeletal, mixed, nonacid, mesic Typic Udifluvents
Estate-----	Fine, mixed, mesic Typic Hapludalfs
Gassville-----	Clayey, mixed, mesic Typic Hapludults
Healing-----	Fine-silty, mixed, mesic Typic Argiudolls
Moko-----	Loamy-skeletal, mixed, mesic Lithic Hapludolls
Mountainburg-----	Loamy-skeletal, siliceous, thermic Lithic Hapludults
Nixa-----	Loamy-skeletal, siliceous, mesic Glossic Fragiudults
Noark-----	Clayey-skeletal, mixed, mesic Typic Paleudults
Portia-----	Fine-loamy, siliceous, mesic Typic Paleudalfs
Ramsey-----	Loamy, siliceous, mesic Lithic Dystrochrepts
Razort-----	Fine-loamy, mixed, mesic Mollic Hapludalfs
Sidon-----	Fine-loamy, siliceous, thermic Typic Fragiudults
Tonti-----	Fine-loamy, mixed, mesic Typic Fragiudults
Ventris-----	Very-fine, mixed, mesic Albaquic Hapludalfs
Wideman-----	Sandy, siliceous, mesic Typic Udifluvents

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Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

LEGEND

AREAS DOMINATED BY DEEP, MODERATELY DEEP, AND SHALLOW, GENTLY SLOPING TO STEEP SOILS, ON RIDGETOPS, SIDE SLOPES, AND BROAD UPLANDS

- 1 Arkana-Moko: Moderately deep and shallow, gently sloping to steep, well drained, cherty and stony soils that formed in residuum of dolomite and limestone
- 2 Doniphan-Gassville: Deep and moderately deep, moderately sloping to steep, well drained, very cherty soils that formed in residuum of cherty dolomite
- 3 Nixa-Doniphan: Deep, gently sloping to moderately sloping, moderately well drained and well drained, very cherty soils that formed in residuum of cherty dolomite

AREAS DOMINATED BY DEEP, NEARLY LEVEL TO STEEP SOILS, ON RIDGETOPS, SIDE SLOPES, AND BROAD UPLANDS

- 4 Clarksville-Noark-Nixa: Deep, gently sloping to steep, somewhat excessively drained, well drained, and moderately well drained, very cherty soils that formed in residuum of cherty limestone
- 5 Nixa-Tonti-Captina: Deep, nearly level to moderately sloping, moderately well drained, loamy and very cherty soils that formed in loamy material over limestone

AREAS DOMINATED BY DEEP, LEVEL TO GENTLY SLOPING SOILS, ON FLOOD PLAINS AND STREAM TERRACES

- 6 Razor-Britwater-Wideman: Deep, level to gently sloping, well drained and excessively drained, loamy and sandy soils that formed in alluvium

AREAS DOMINATED BY DEEP AND SHALLOW GENTLY SLOPING TO STEEP SOILS, ON SIDE SLOPES, FOOT SLOPES, AND ROLLING UPLANDS

- 7 Portia-Estate: Deep, gently sloping to moderately sloping, well drained, loamy and stony soils that formed in residuum of interbedded sandstone and limestone
- 8 Portia-Estate-Moko: Deep and shallow, gently sloping to steep, well drained, loamy and stony soils that formed in residuum and colluvium of interbedded sandstone and limestone

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FOREST SERVICE
ARKANSAS AGRICULTURAL EXPERIMENT STATION
GENERAL SOIL MAP
MARION COUNTY, ARKANSAS

Scale 1:253,440

1 0 1 2 3 4 Miles



1 0 4 8 Km

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



LEGEND



AREAS DOMINATED BY DEEP, MODERATELY DEEP, AND SHALLOW, NEARLY LEVEL TO STEEP SOILS. ON RIDGETOPS, SIDE SLOPES, AND BROAD UPLANDS

-  Arkana-Moko: Moderately deep and shallow, gently sloping to steep, well drained, cherty and stony soils that formed in residuum of dolomite and limestone
-  Captina-Tonti-Nixa: Deep, nearly level to moderately sloping, moderately well drained, loamy and cherty soils that formed in residuum of cherty dolomite
-  Doniphan-Gassville: Deep and moderately deep, moderately sloping to steep, well drained, very cherty soils that formed in residuum of cherty dolomite
-  Doniphan-Nixa: Deep, gently sloping to moderately sloping, well drained and moderately well drained, very cherty soils that formed in residuum of cherty dolomite
-  Doniphan-Ventris: Deep and moderately deep, gently sloping, well drained and moderately well drained, very cherty and cherty soils that formed in residuum of cherty dolomite


AREAS DOMINATED BY DEEP, LEVEL TO GENTLY SLOPING SOILS; ON FLOOD PLAINS AND STREAM TERRACES

-  Healing-Razor-Britwater: Deep, level to gently sloping, well drained, loamy soils that formed in alluvium


AREAS DOMINATED BY DEEP AND SHALLOW, GENTLY SLOPING TO STEEP SOILS; ON BROAD UPLAND AREAS, SIDE SLOPES, AND FOOT SLOPES

-  Brockwell-Portia: Deep, gently sloping to moderately steep, well drained, loamy soils that formed in residuum of sandstone and interbedded sandstone and limestone
-  Estate-Portia-Moko: Deep and shallow, gently sloping to steep, well drained, stony and loamy soils that formed in residuum and colluvium of interbedded sandstone and limestone

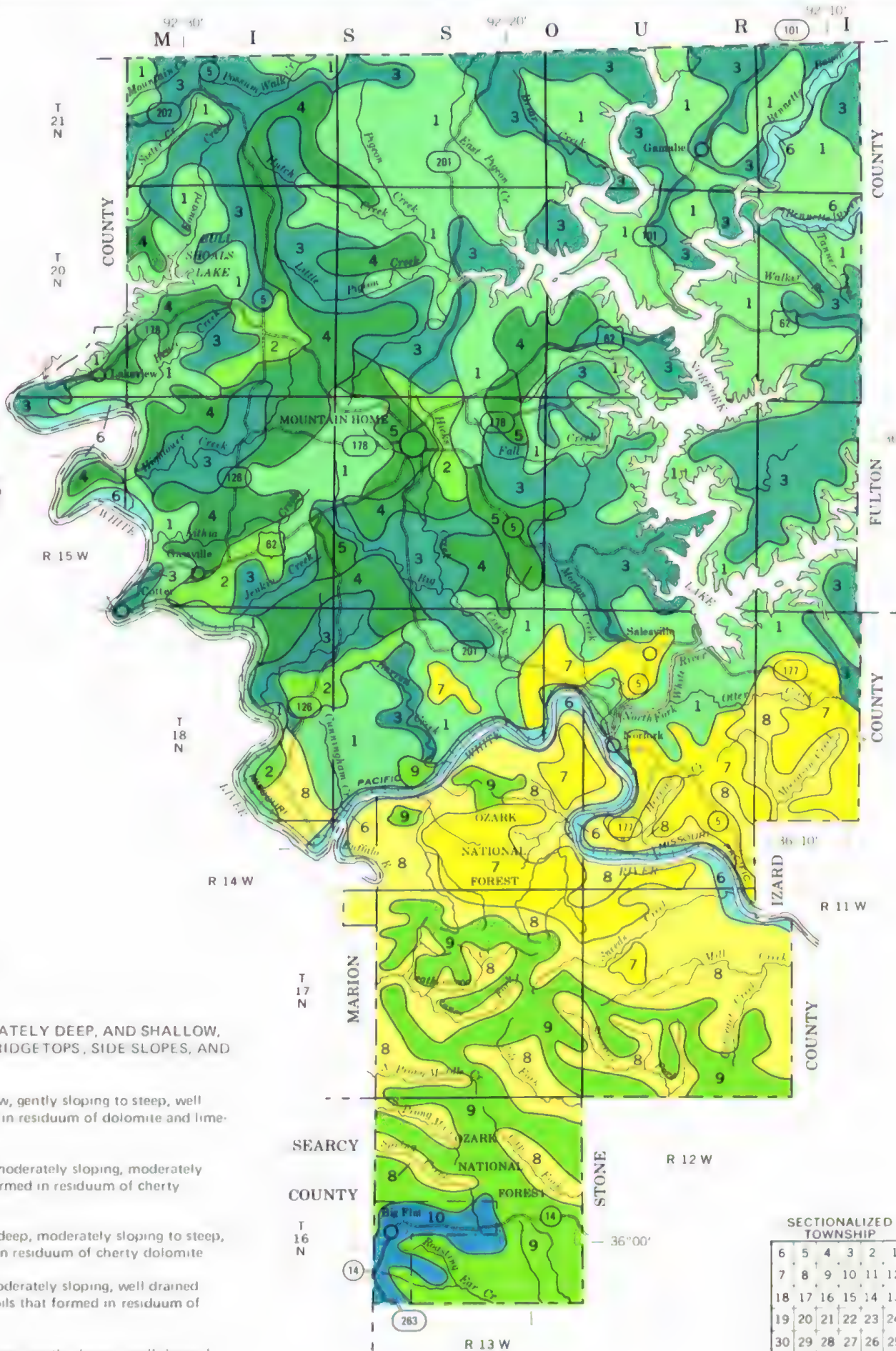
AREAS DOMINATED BY DEEP, GENTLY SLOPING TO STEEP SOILS; ON SIDE SLOPES AND RIDGETOPS

-  Clarksville-Nixa-Noark: Deep, gently sloping to steep, somewhat excessively drained, moderately well drained and well drained, very cherty soils that formed in residuum of cherty limestone

AREAS DOMINATED BY SHALLOW AND DEEP, GENTLY SLOPING TO STEEP SOILS; ON MOUNTAINTOPS AND SIDE SLOPES

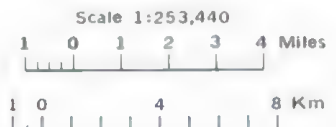
-  Mountainburg-Sidon: Shallow and deep, gently sloping to steep, well drained and moderately well drained, stony and loamy soils that formed in residuum of acid sandstone

Compiled 1980

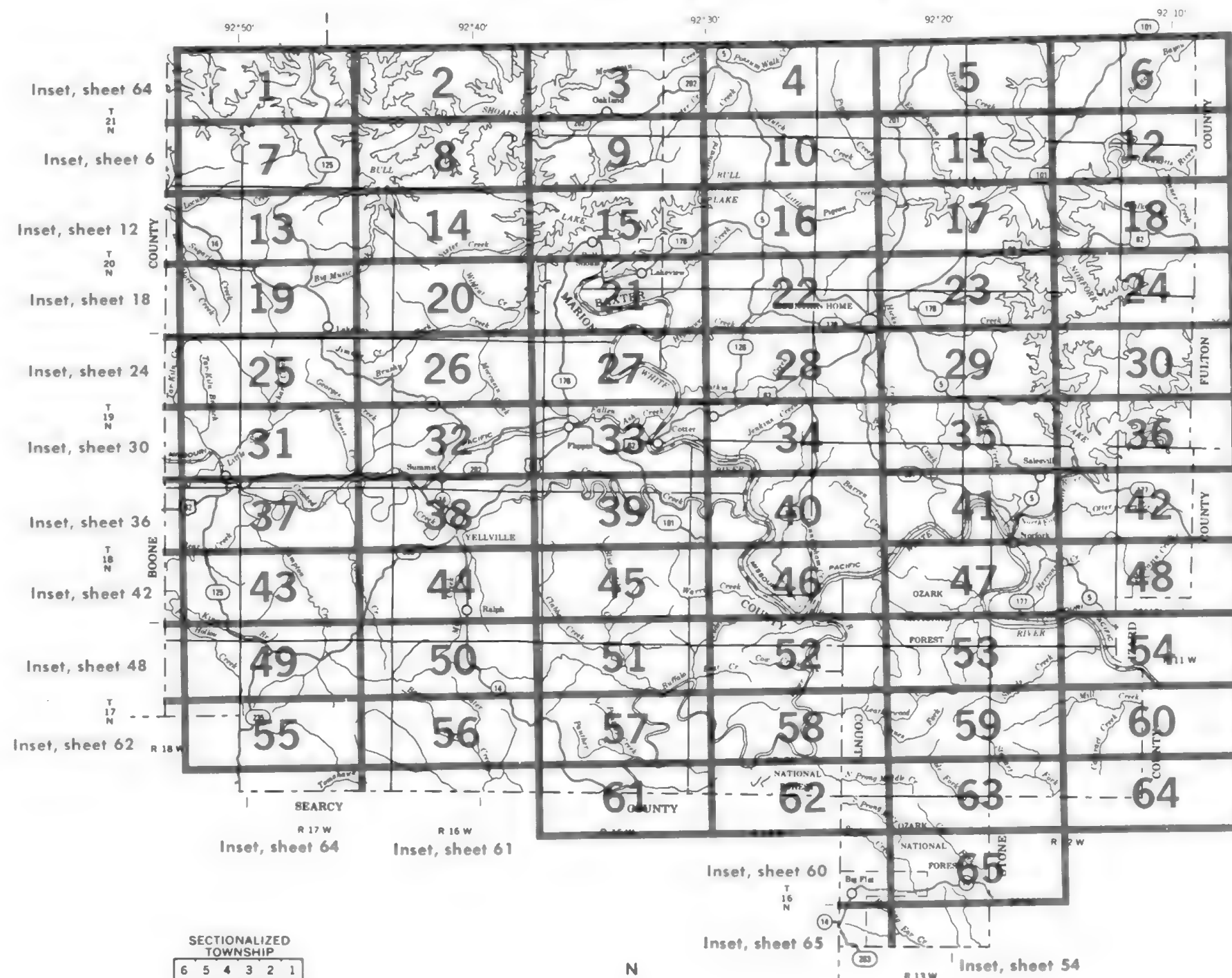


U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FOREST SERVICE
ARKANSAS AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP BAXTER COUNTY, ARKANSAS



M I S S O U R I



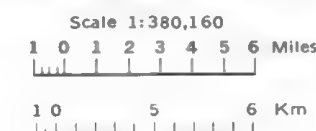
SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Original text from each individual map sheet read:

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey from 1980 aerial photography. Coordinate grid ticks and land division corners, are approximately positioned.

INDEX TO MAP SHEETS BAXTER AND MARION COUNTIES, ARKANSAS



SOIL LEGEND

The legend is numeric. Soil names followed by the superscript 1/ are broadly defined units. The composition of these units is more variable than that of other units in the survey area, but is controlled well enough to be interpreted for the expected use of the soils. Soils without a slope designation in the name are those that are found only on nearly level landscapes of frequently flooded bottom lands.

SYMBOL	NAME
1	Arkana very cherty silt loam, 3 to 8 percent slopes
2	Arkana-Moko complex, 3 to 8 percent slopes
3	Arkana-Moko complex, 8 to 20 percent slopes
4	Arkana-Moko complex, 20 to 40 percent slopes
5	Britwater silt loam, 1 to 3 percent slopes
6	Britwater silt loam, 3 to 8 percent slopes
7	Britwater gravelly silt loam, 3 to 8 percent slopes
8	Brockwell sandy loam, 3 to 8 percent slopes
9	Brockwell gravelly sandy loam, 3 to 8 percent slopes
10	Brockwell gravelly sandy loam, 8 to 20 percent slopes
11	Captina silt loam, 1 to 3 percent slopes
12	Captina silt loam, 3 to 8 percent slopes
13	Clarksville very cherty silt loam, 20 to 50 percent slopes
14	Doniphan very cherty silt loam, 3 to 8 percent slopes
15	Doniphan very cherty silt loam, 8 to 20 percent slopes
16	Elsah cherty loam, frequently flooded
17	Estate-Portia-Moko association, rolling 1/
18	Estate-Portia-Moko association, steep 1/
19	Gassville very cherty silt loam, 20 to 40 percent slopes
20	Healing silt loam, 1 to 3 percent slopes
21	Moko-Rock outcrop complex, 3 to 15 percent slopes
22	Moko-Rock outcrop complex, 15 to 40 percent slopes
23	Mountainburg gravelly loam, 3 to 8 percent slopes
24	Mountainburg very stony sandy loam, 3 to 15 percent slopes
25	Mountainburg very stony sandy loam, 15 to 40 percent slopes
26	Nixa very cherty silt loam, 3 to 8 percent slopes
27	Nixa very cherty silt loam, 8 to 12 percent slopes
28	Nixa-Doniphan complex, 3 to 8 percent slopes
29	Nixa-Doniphan complex, 8 to 20 percent slopes
30	Nixa-Noark complex, 3 to 8 percent slopes
31	Nixa-Noark complex, 8 to 20 percent slopes
32	Noark very cherty silt loam, 3 to 8 percent slopes
33	Noark very cherty silt loam, 8 to 20 percent slopes
34	Noark very cherty silt loam, 20 to 40 percent slopes
35	Portia fine sandy loam, 3 to 8 percent slopes
36	Portia fine sandy loam, 8 to 12 percent slopes
37	Razort silt loam, frequently flooded
38	Sidon silt loam, 3 to 8 percent slopes
39	Tonti cherty silt loam, 3 to 8 percent slopes
40	Udorthents-Ramsey-Rock outcrop complex, 3 to 20 percent slopes
41	Ventris cherty silt loam, 3 to 8 percent slopes
42	Wideman sandy loam, frequently flooded

CONVENTIONAL AND SPECIAL
SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES	
National, state or province	=====
County or parish	=====
Minor civil division	-----
Reservation (national forest or park, state forest or park, and large airport)	-----
Land grant	-----
Limit of soil survey (label)	-----
Field sheet matchline & neatline	-----
AD HOC BOUNDARY (label)	-----
Small airport, airfield, park, oilfield, cemetery, or flood pool	-----
STATE COORDINATE TICK	
LAND DIVISION CORNERS (sections and land grants)	-----
ROADS	
Divided (median shown if scale permits)	=====
Other roads	=====
Trail	-----
ROAD EMBLEM & DESIGNATIONS	
Interstate	-----
Federal	-----
State	-----
County, farm or ranch	-----
RAILROAD	
POWER TRANSMISSION LINE (normally not shown)	
PIPE LINE (normally not shown)	
FENCE (normally not shown)	
LEVEES	
Without road	=====
With road	=====
With railroad	=====
DAMS	
Large (to scale)	=====
Medium or small	=====
PITS	
Gravel pit	-----
Mine or quarry	-----

MISCELLANEOUS CULTURAL FEATURES	
Farmstead, house (omit in urban areas)	-----
Church	-----
School	-----
Indian mound (label)	-----
Located object (label)	-----
Tank (label)	-----
Wells, oil or gas	-----
Windmill	-----
Kitchen midden	-----

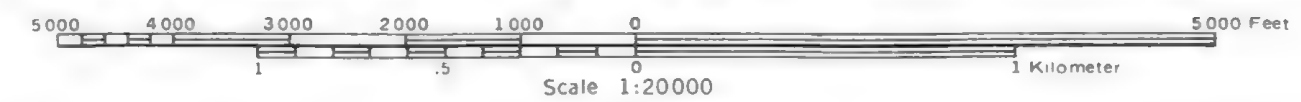
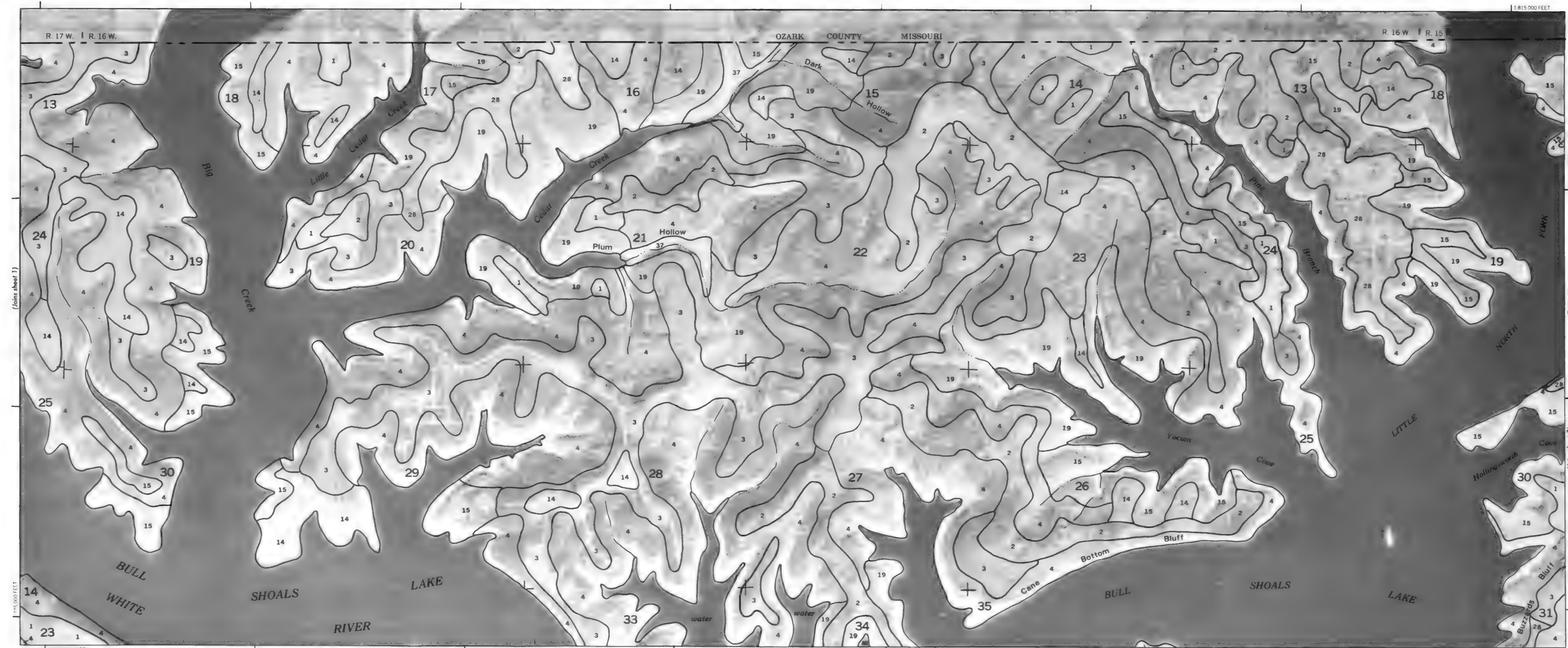
WATER FEATURES

DRAINAGE	
Perennial, double line	=====
Perennial, single line	=====
Intermittent	-----
Drainage end	-----
Canals or ditches	=====
Double-line (label)	=====
Drainage and/or irrigation	=====
LAKES, PONDS AND RESERVOIRS	
Perennial	=====
Intermittent	=====
MISCELLANEOUS WATER FEATURES	
Marsh or swamp	=====
Spring	-----
Well, artesian	-----
Well, irrigation	-----
Wet spot	-----

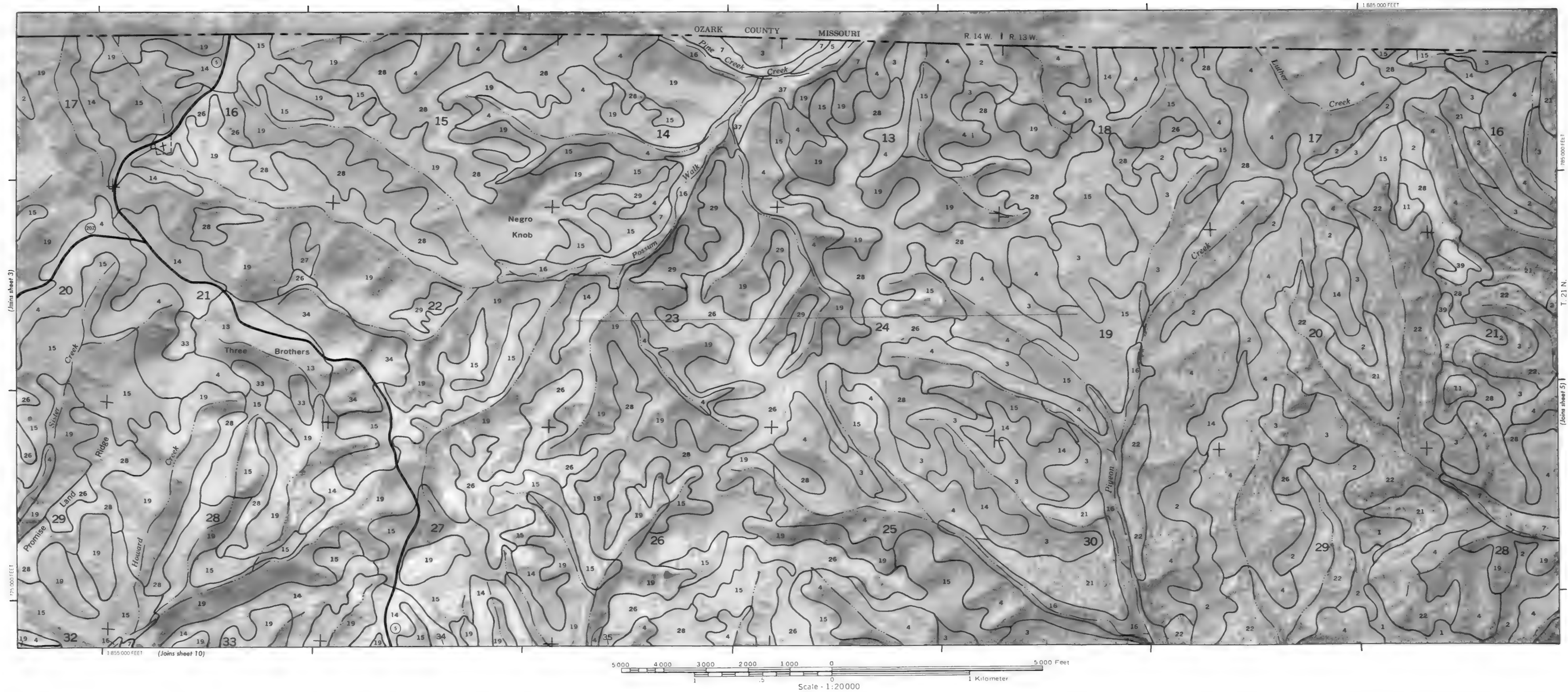
SPECIAL SYMBOLS FOR
SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS	
ESCARPMENTS	
Bedrock (points down slope)	=====
Other than bedrock (points down slope)	=====
SHORT STEEP SLOPE	
GULLY	
DEPRESSION OR SINK	
SOIL SAMPLE SITE (normally not shown)	
MISCELLANEOUS	
Blowout	-----
Clay spot	-----
Gravelly spot	-----
Gumbo, slick or scabby spot (sodic)	-----
Dumps and other similar non soil areas	=====
Prominent hill or peak	-----
Rock outcrop (includes sandstone and shale)	-----
Saline spot	-----
Sandy spot	-----
Severely eroded spot	=====
Slide or slip (tips point upslope)	=====
Stony spot, very stony spot	-----

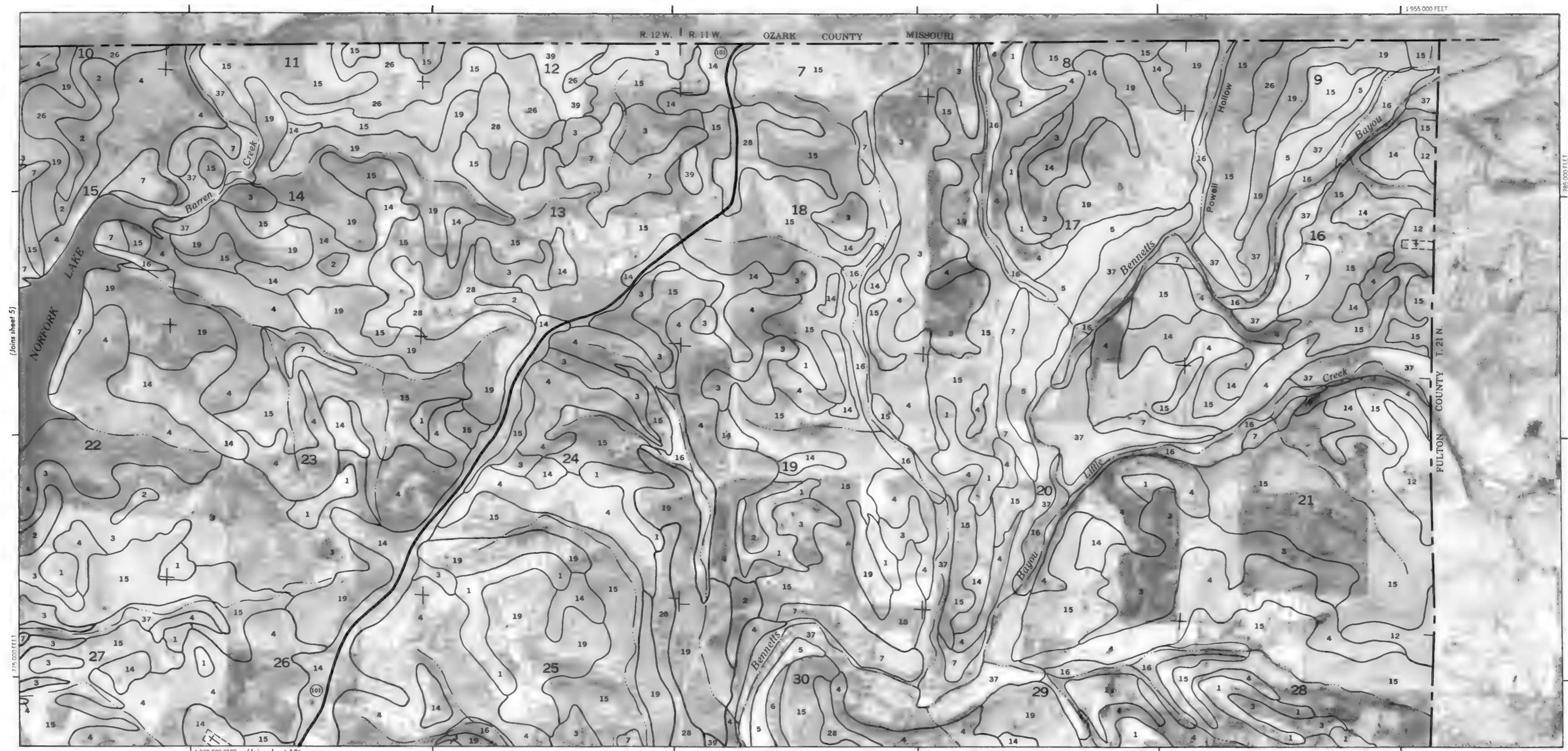




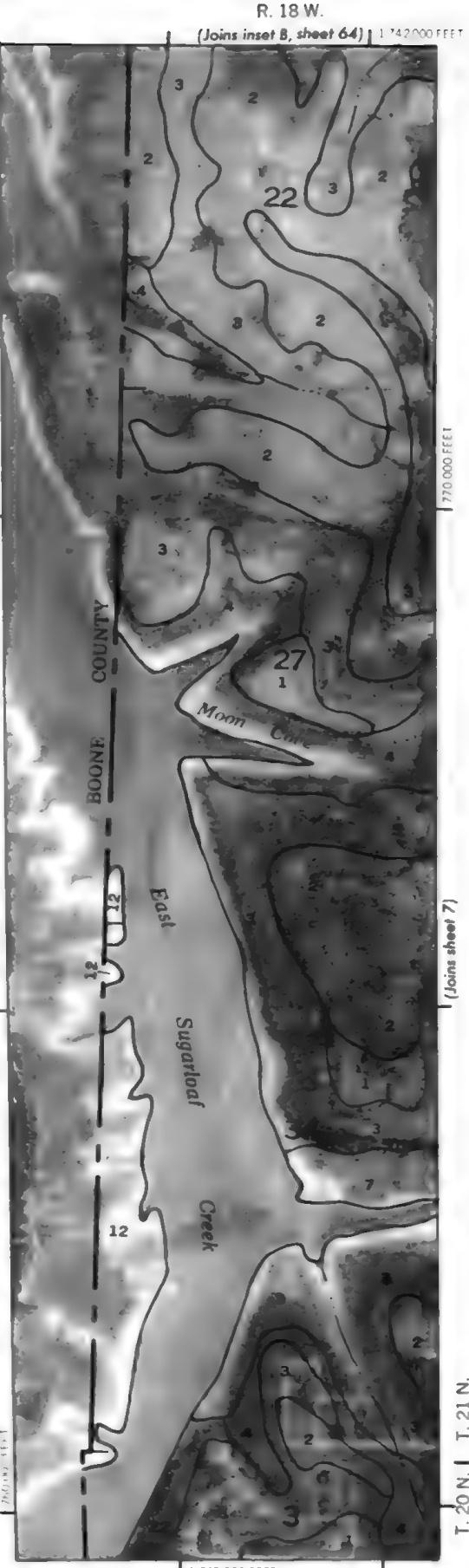
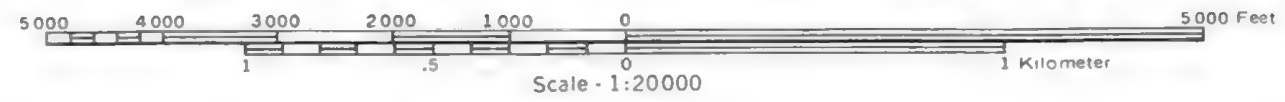






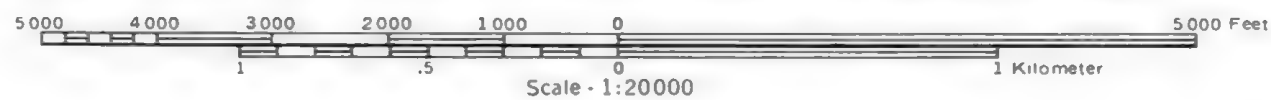
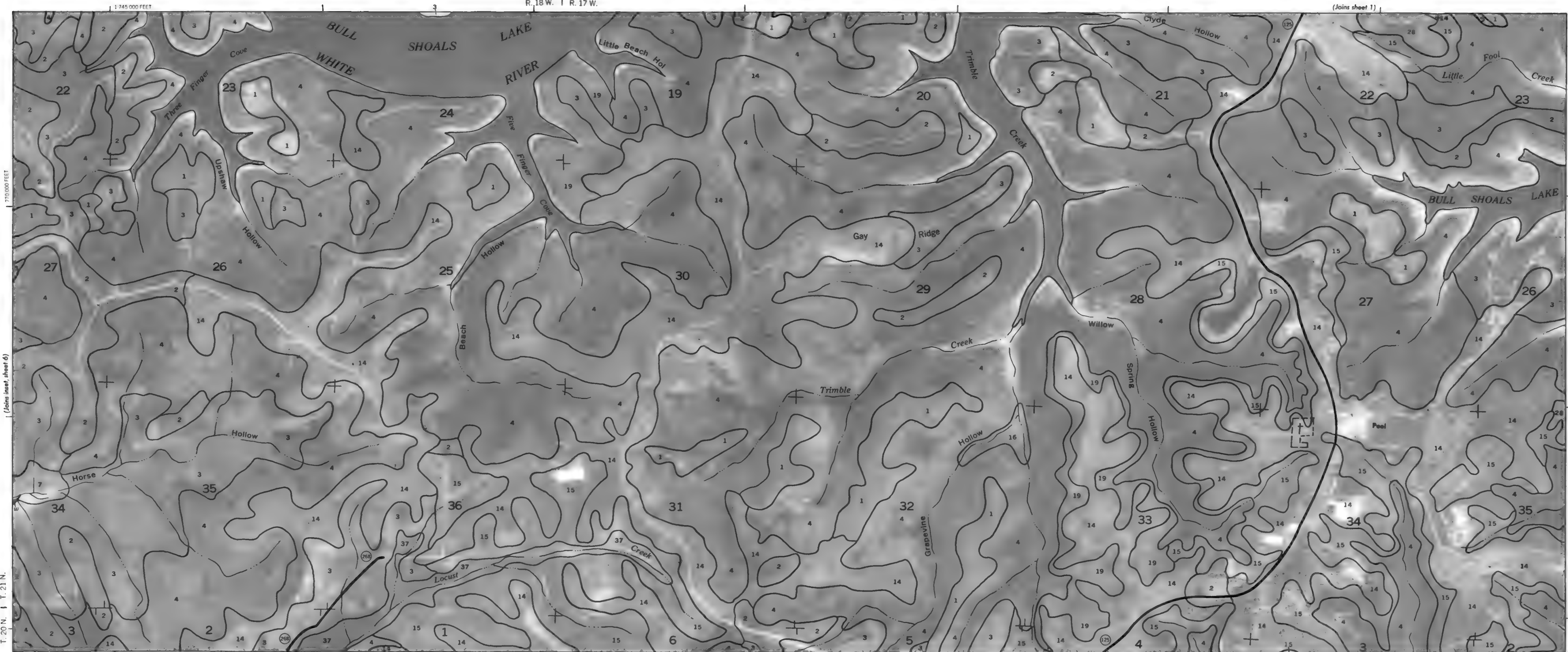


1930 000 FEET (Joins sheet 12)



1740 000 FEET (Joins inset, sheet 12)

2000 AND 5000 FOOT GRID TICKS



(Joins sheet 13) 1 775 000 FEET

(Joins sheet 8)

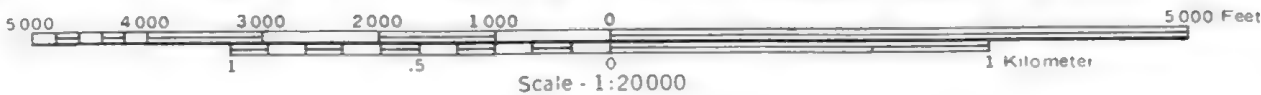
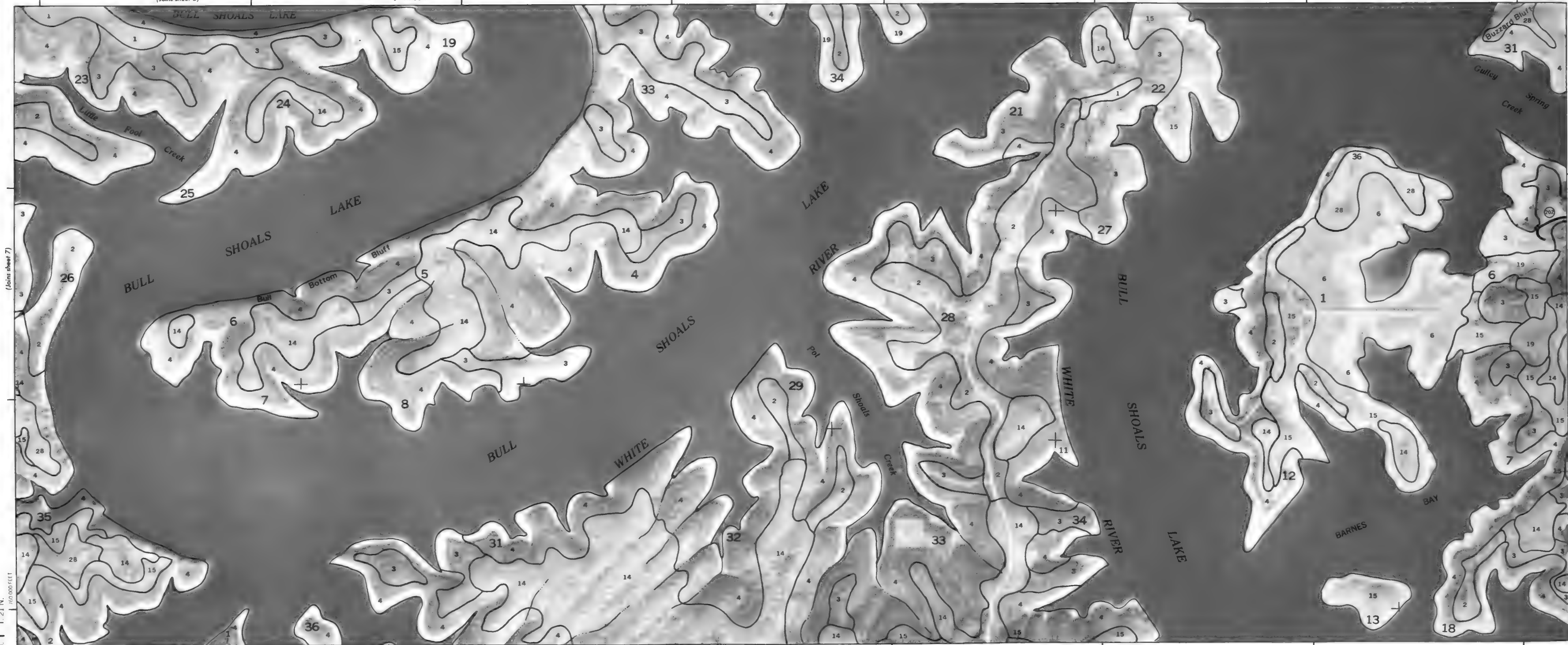
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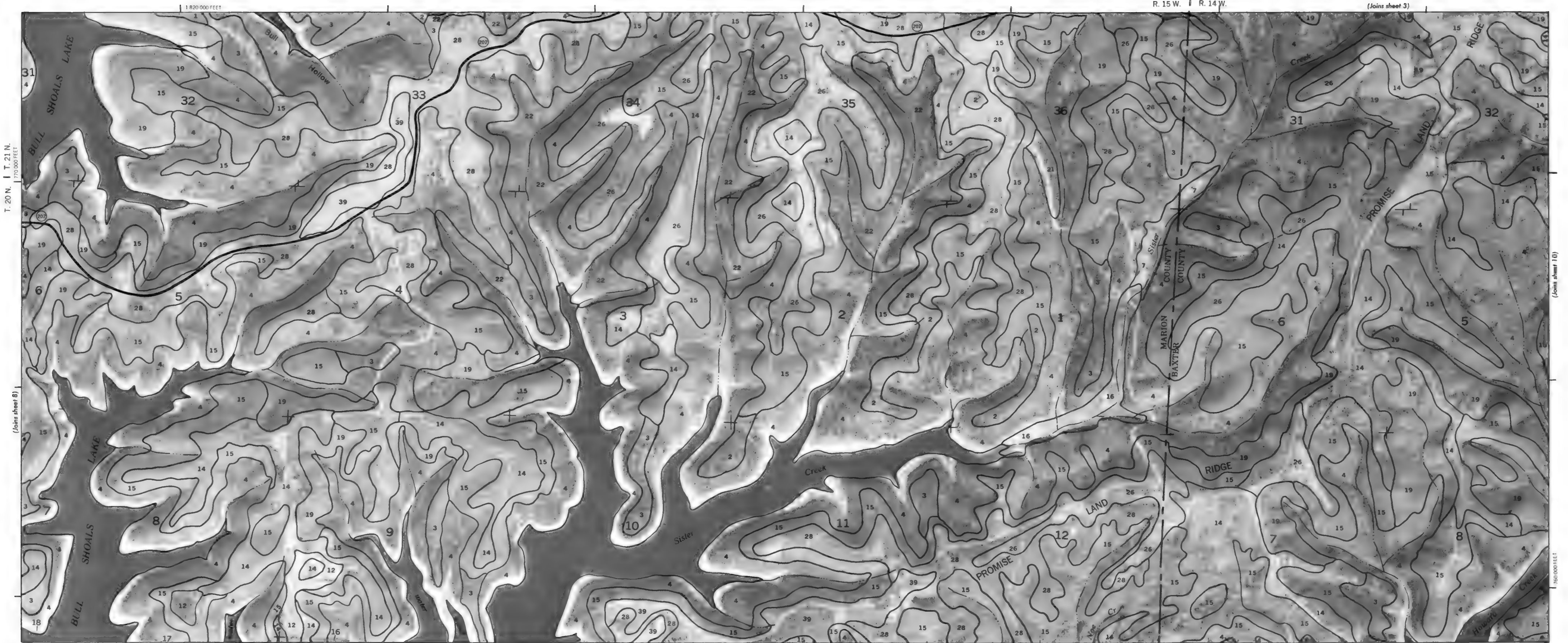
(Joins inset sheet 6)

T. 20 N. | T. 21 N.

1 745 000 FEET

R. 18 W. | R. 17 W.



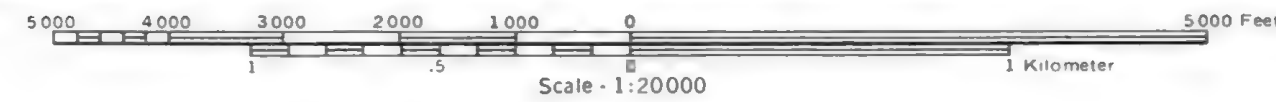


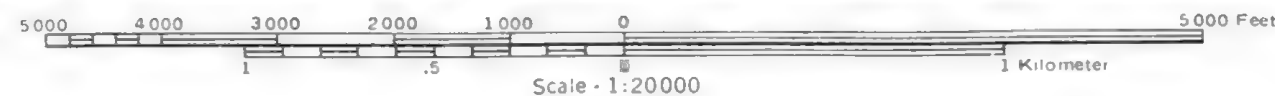
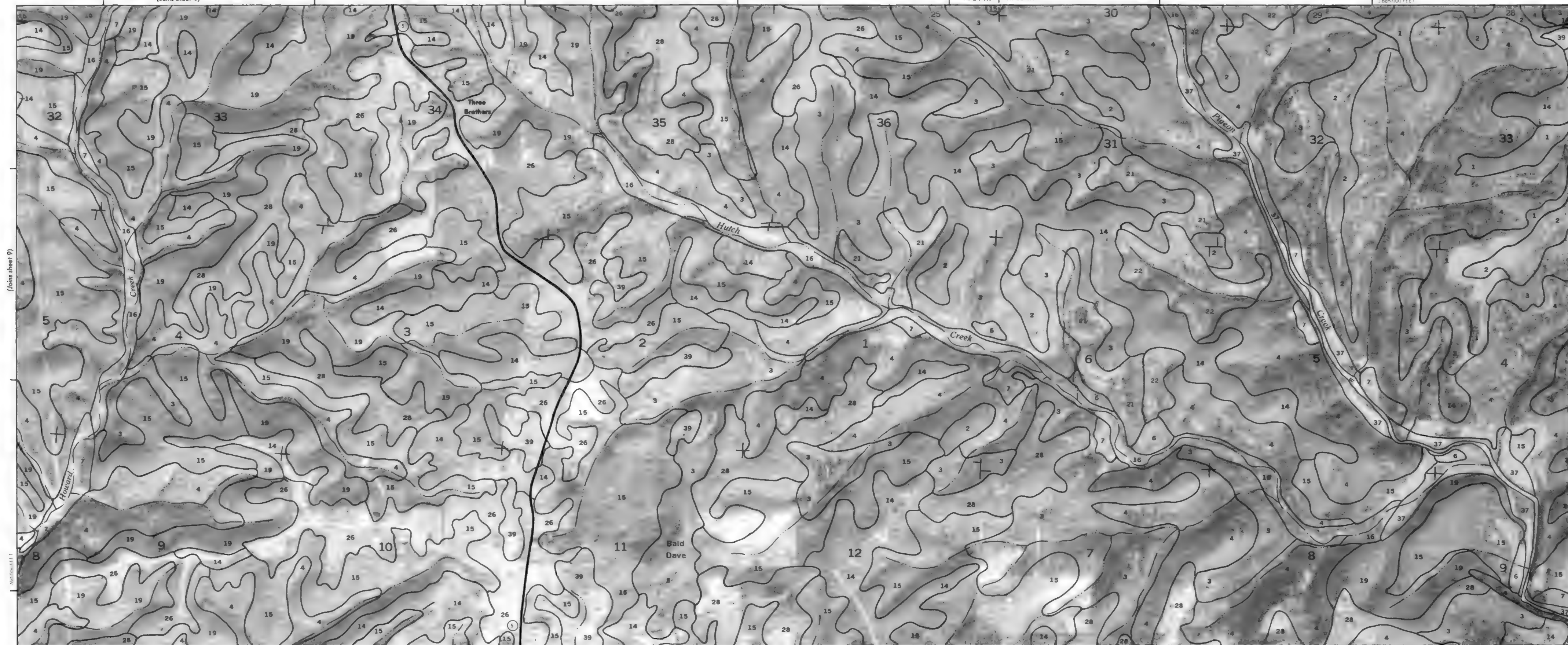
T. 20 N. | T. 21 N.

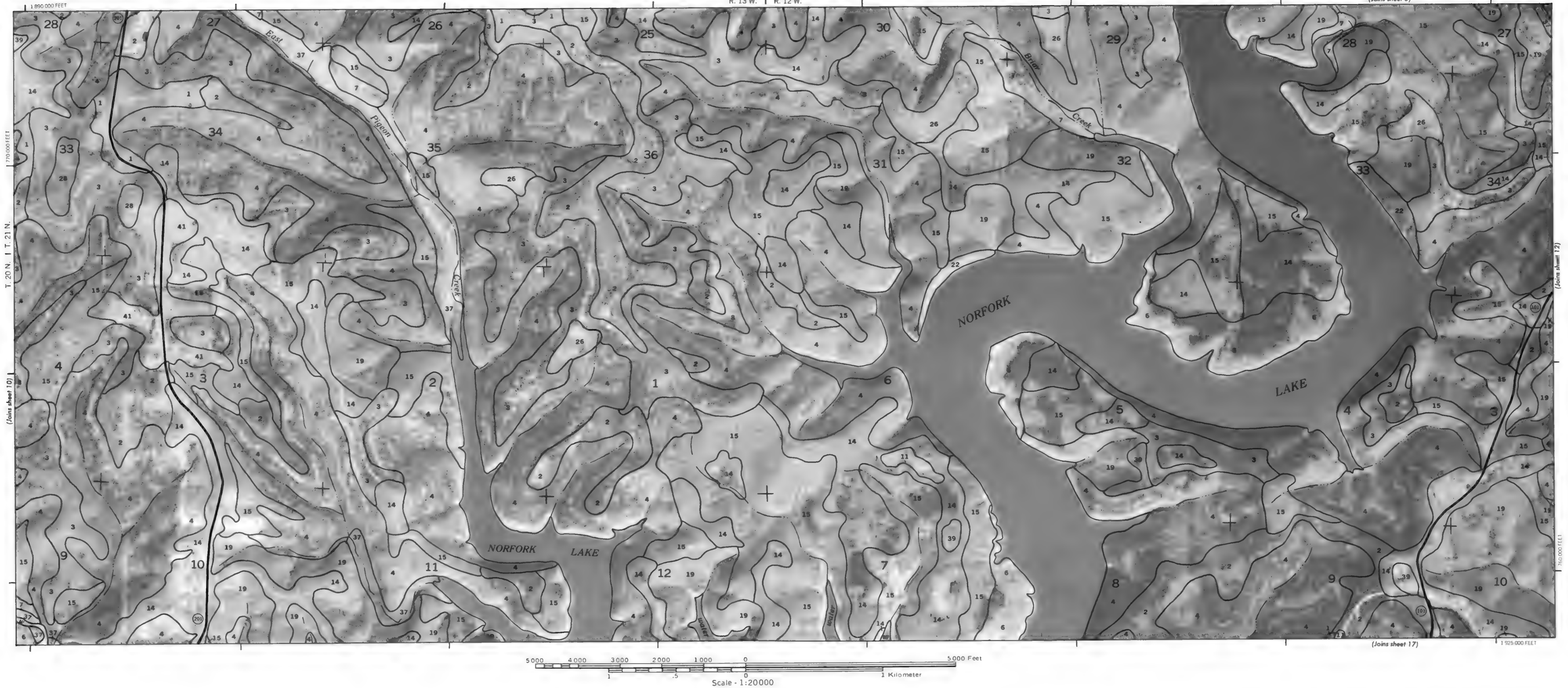
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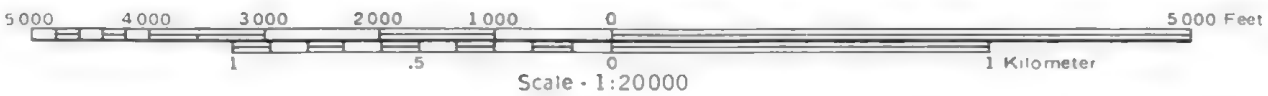
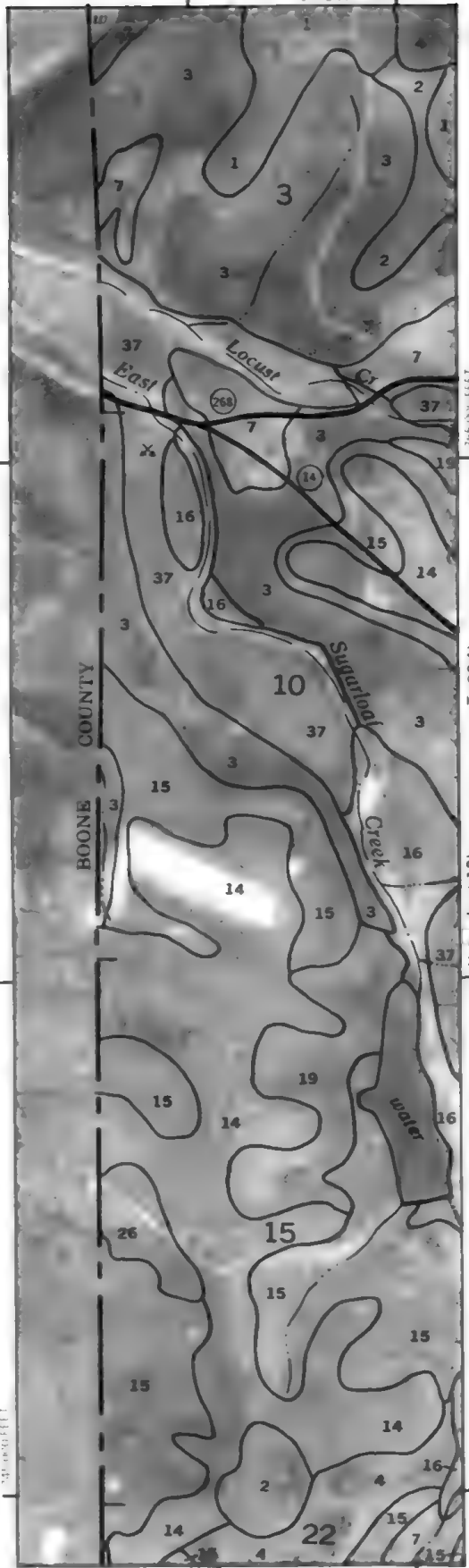
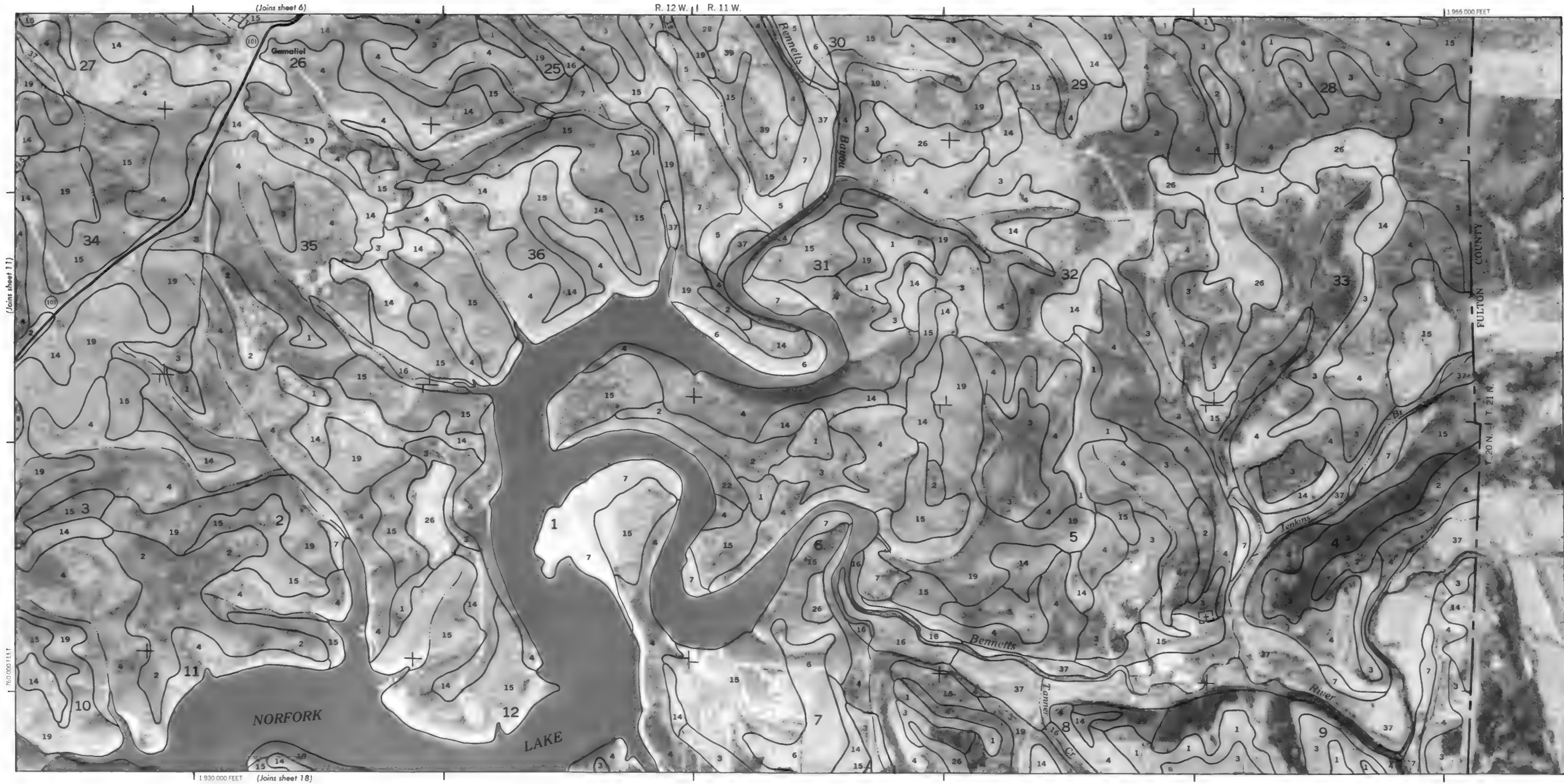
(Joins sheet 10)

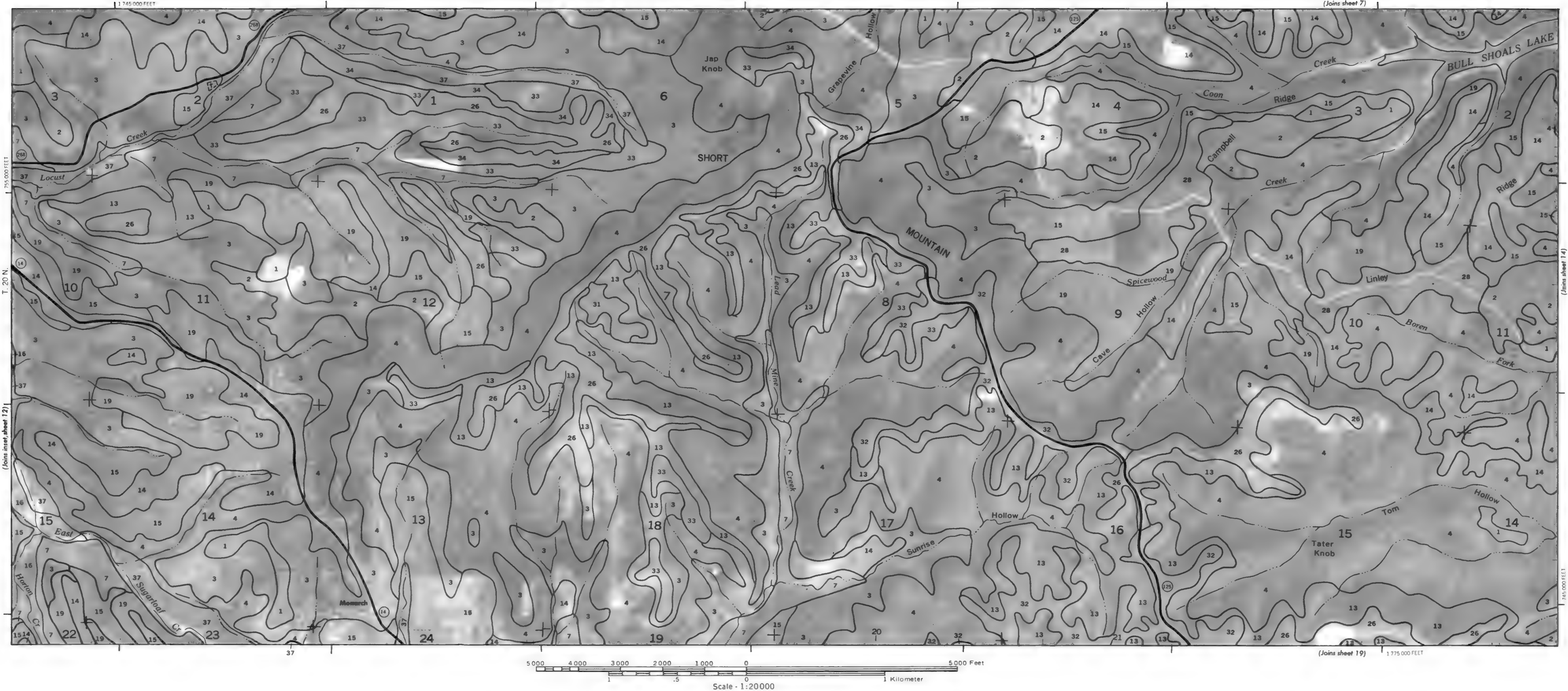
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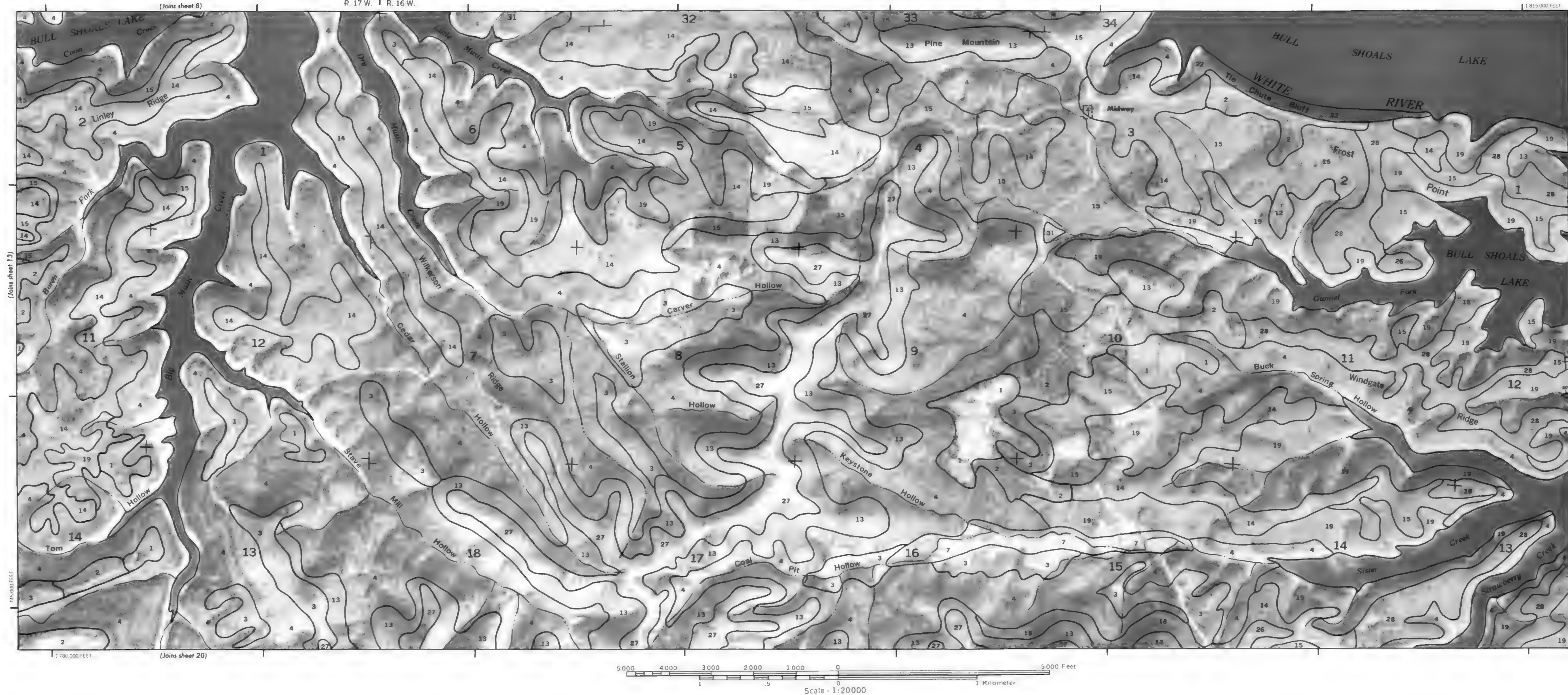


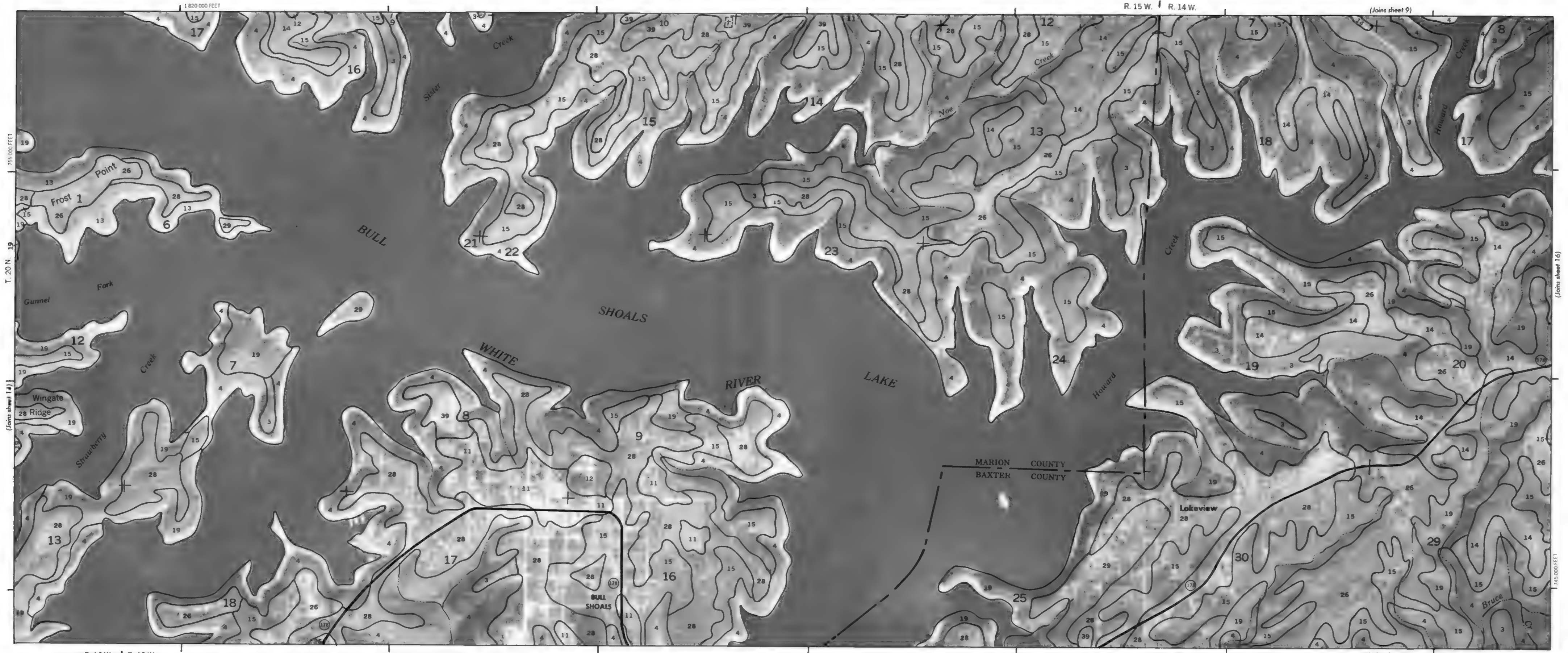








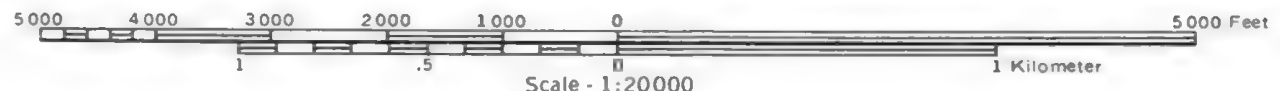




T. 20 N. 19
(Joins sheet 14)

(Joins sheet 16)

745,000 FEET

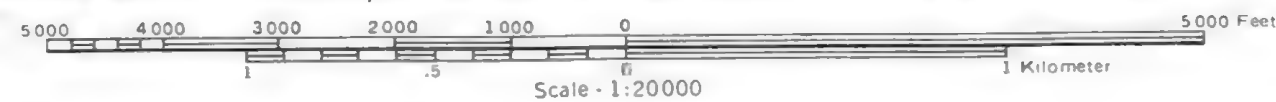
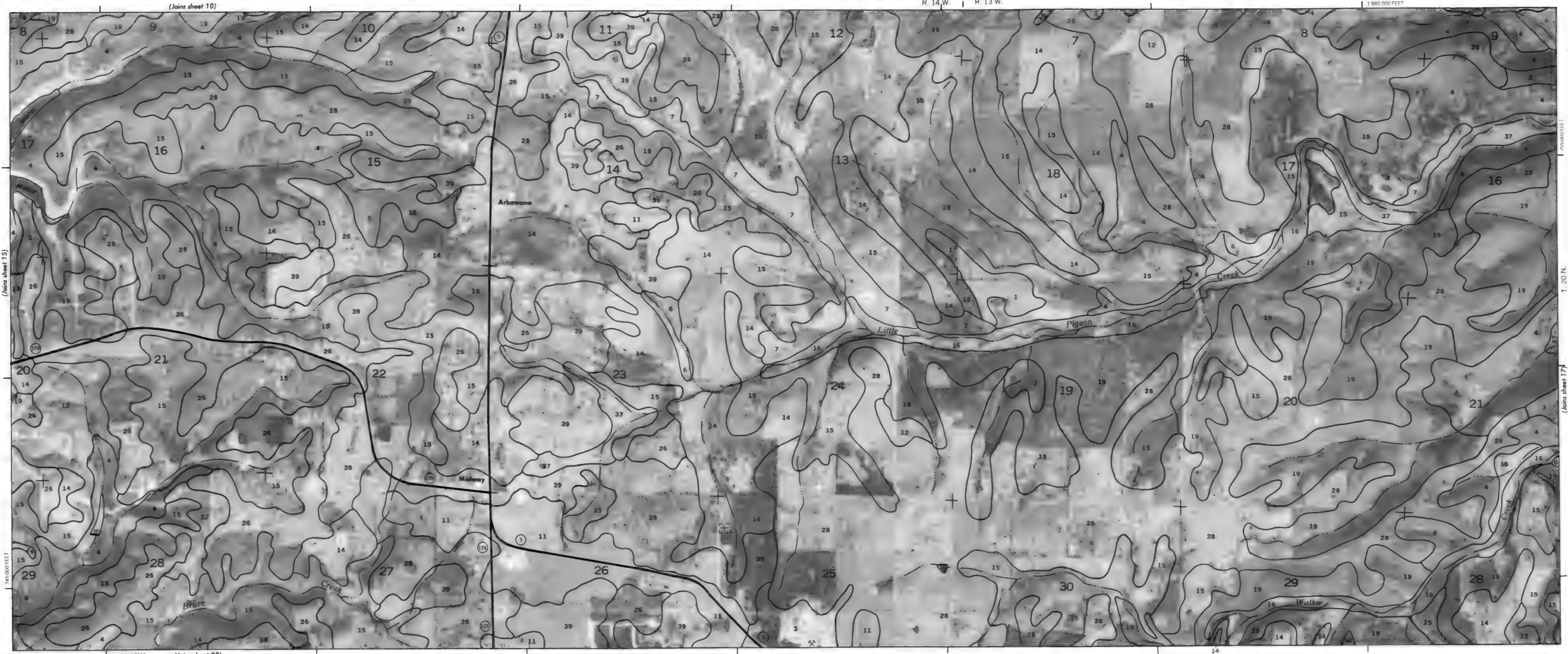


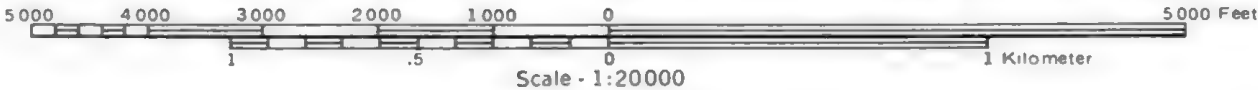
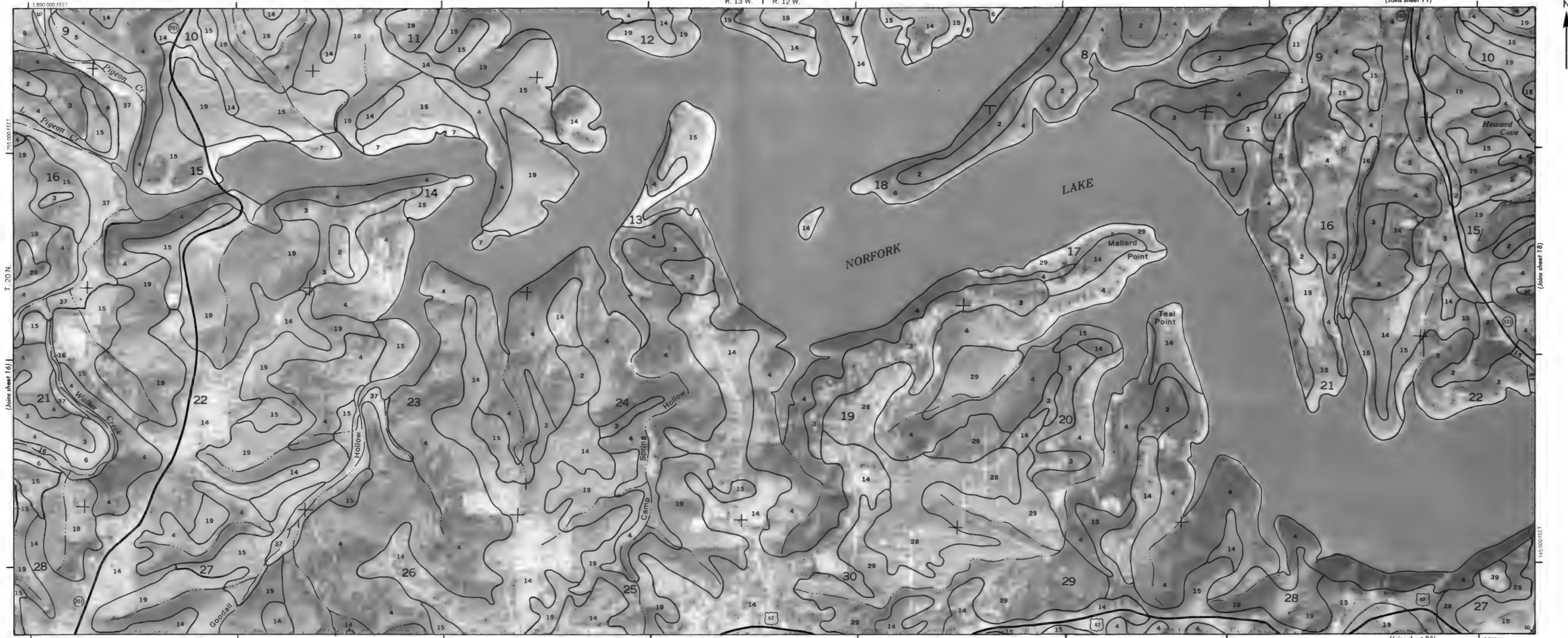
(Joins sheet 21) 1,850,000 FEET

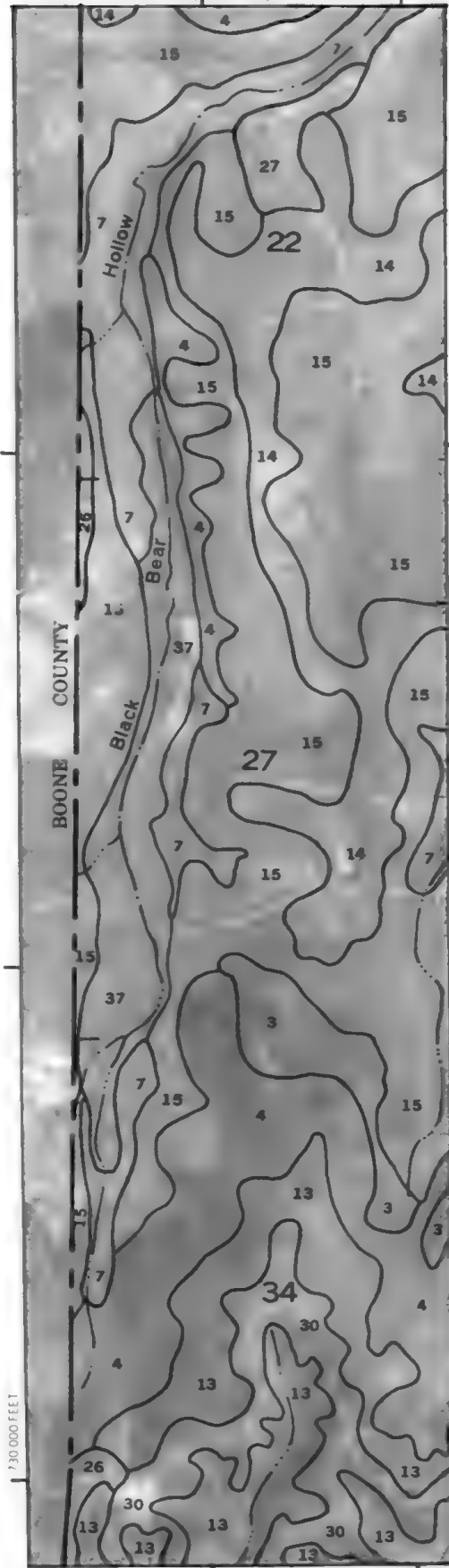
R. 16 W. R. 15 W.

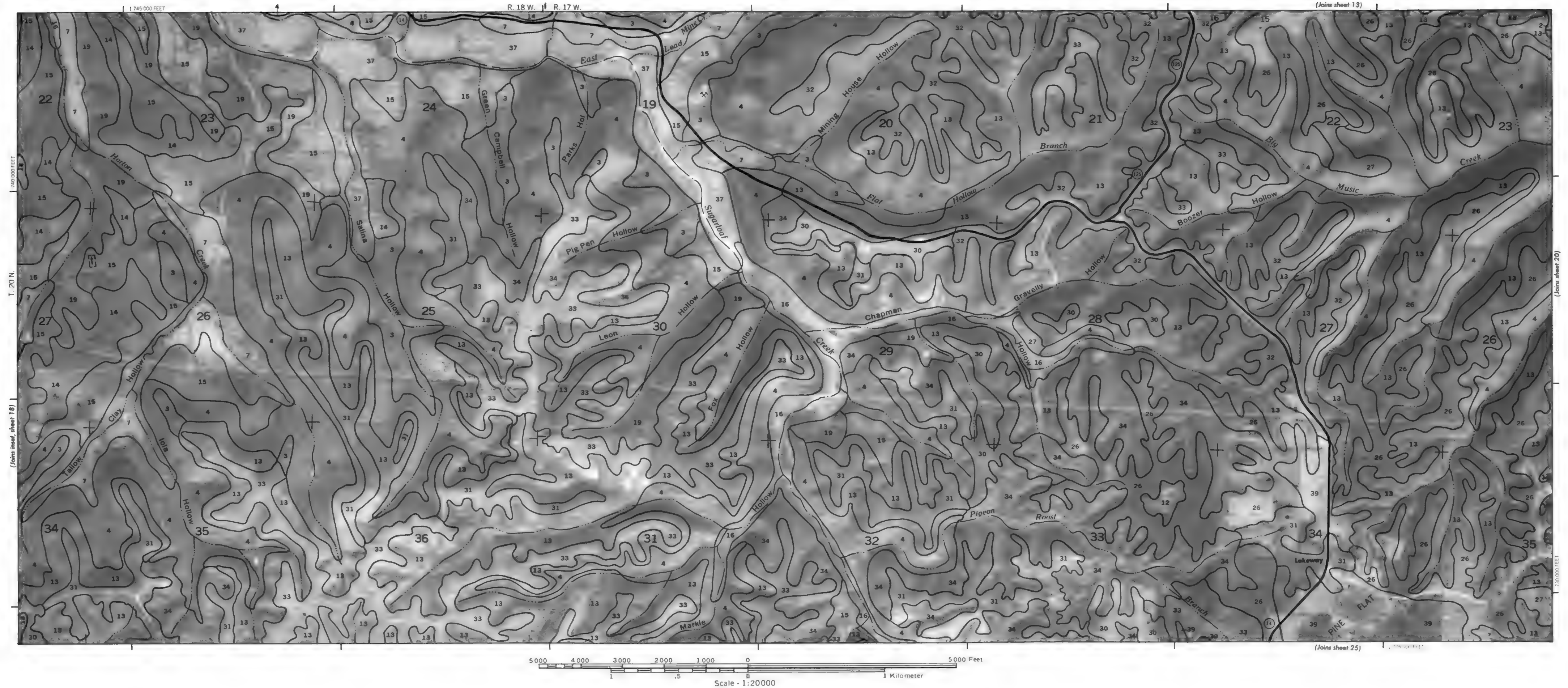
R. 15 W. R. 14 W.

(Joins sheet 9)











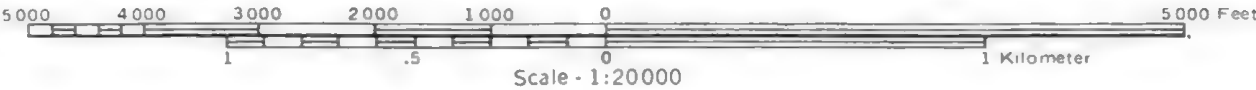
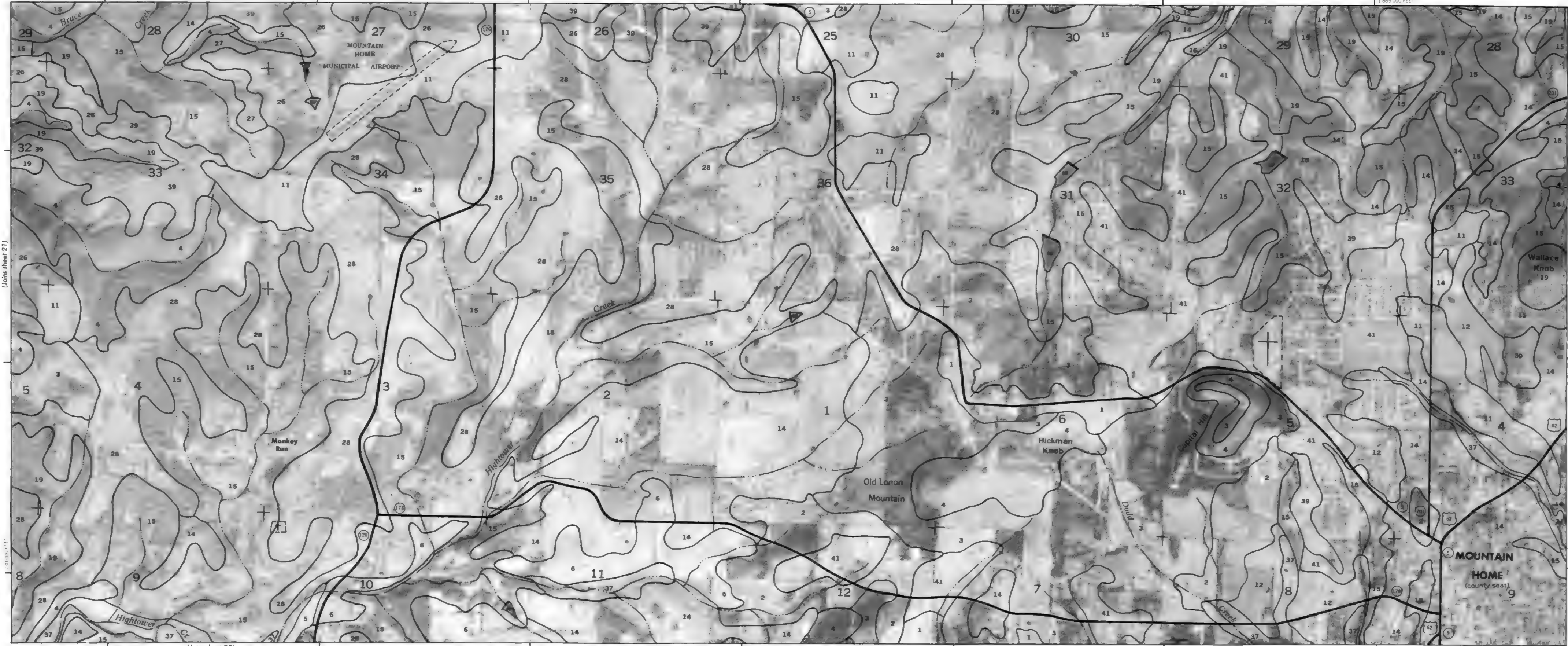


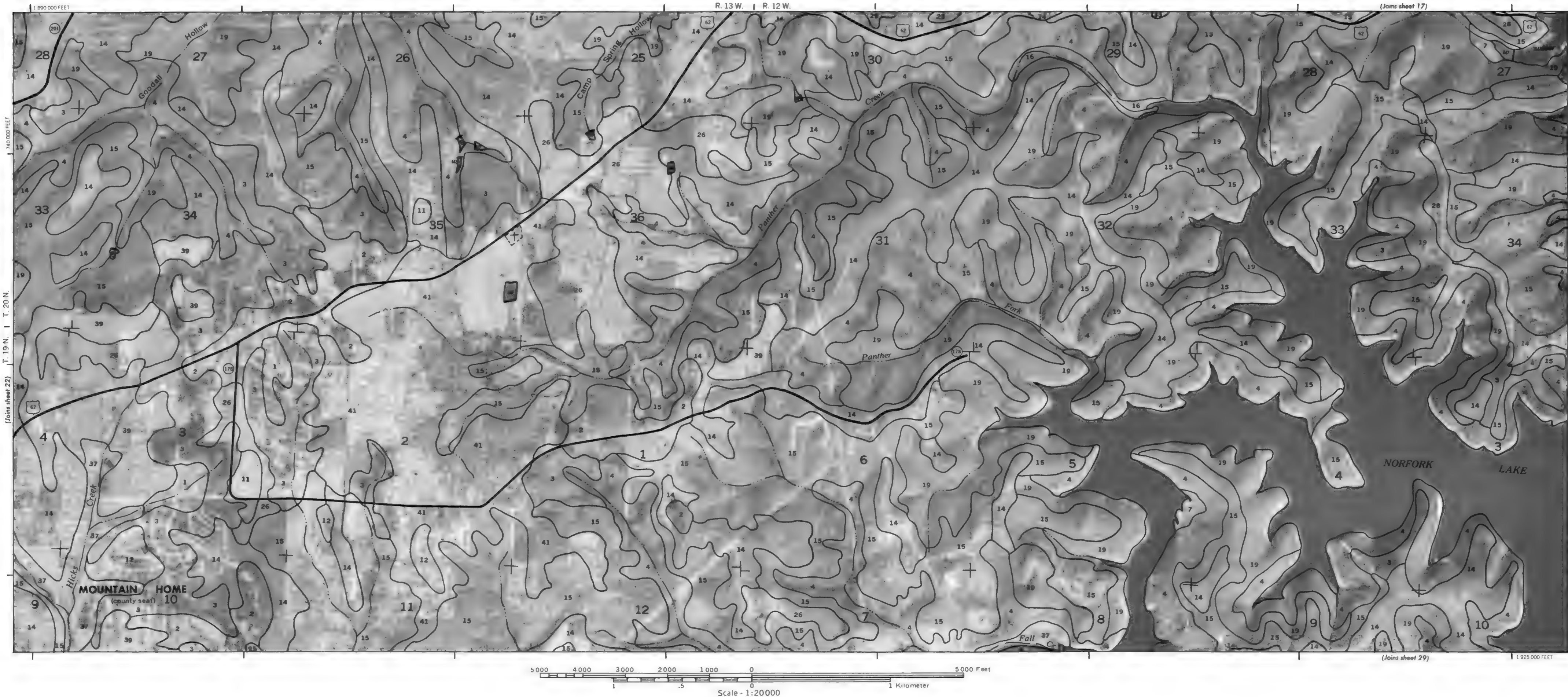
R. 14 W. | R. 13 W.

1:885,000 FEET

(Joins sheet 16)

(Joins sheet 28)



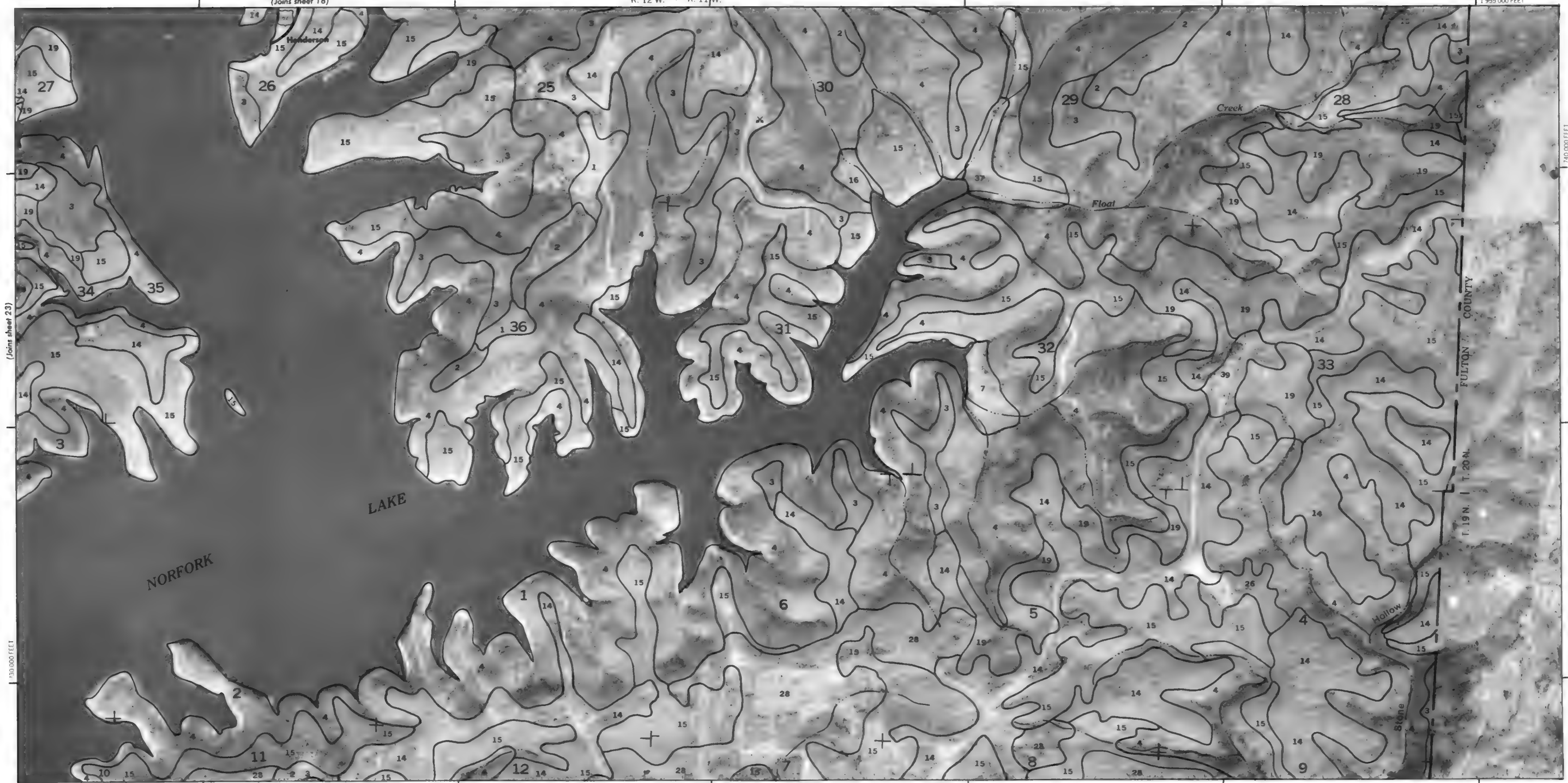




(Joins sheet 18)

R. 12 W. | R. 11 W.

1 955 000 FEET

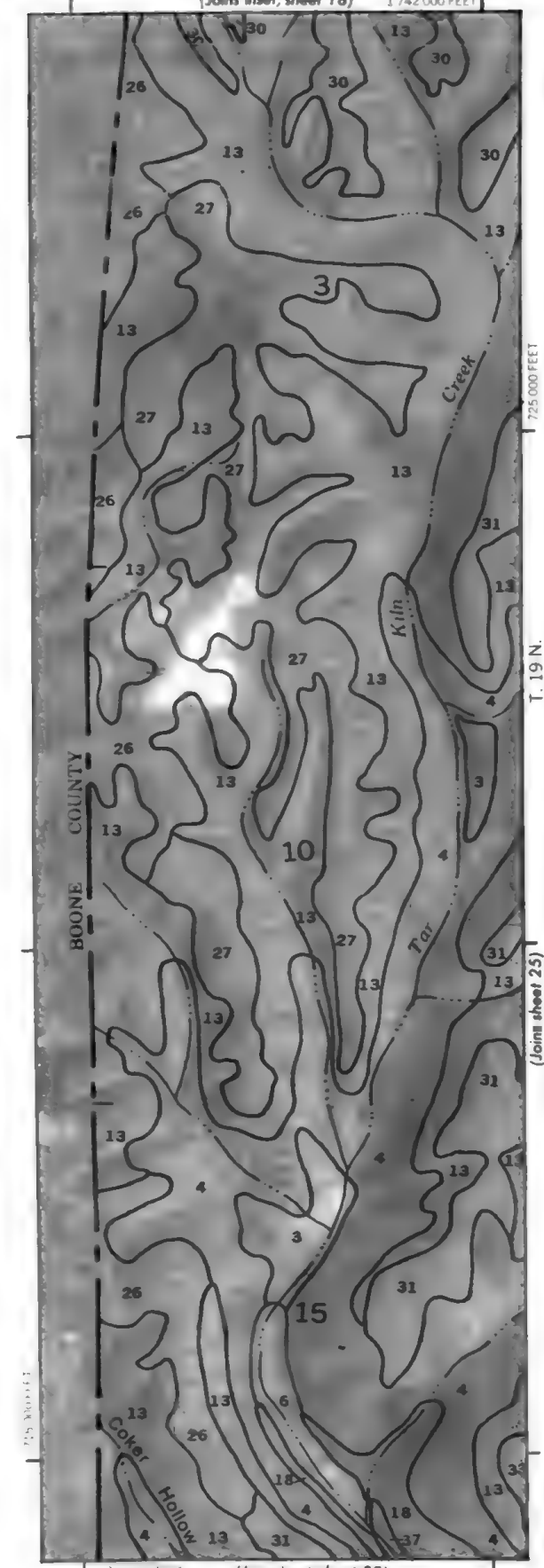


1 930 000 FEET (Joins sheet 30)

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

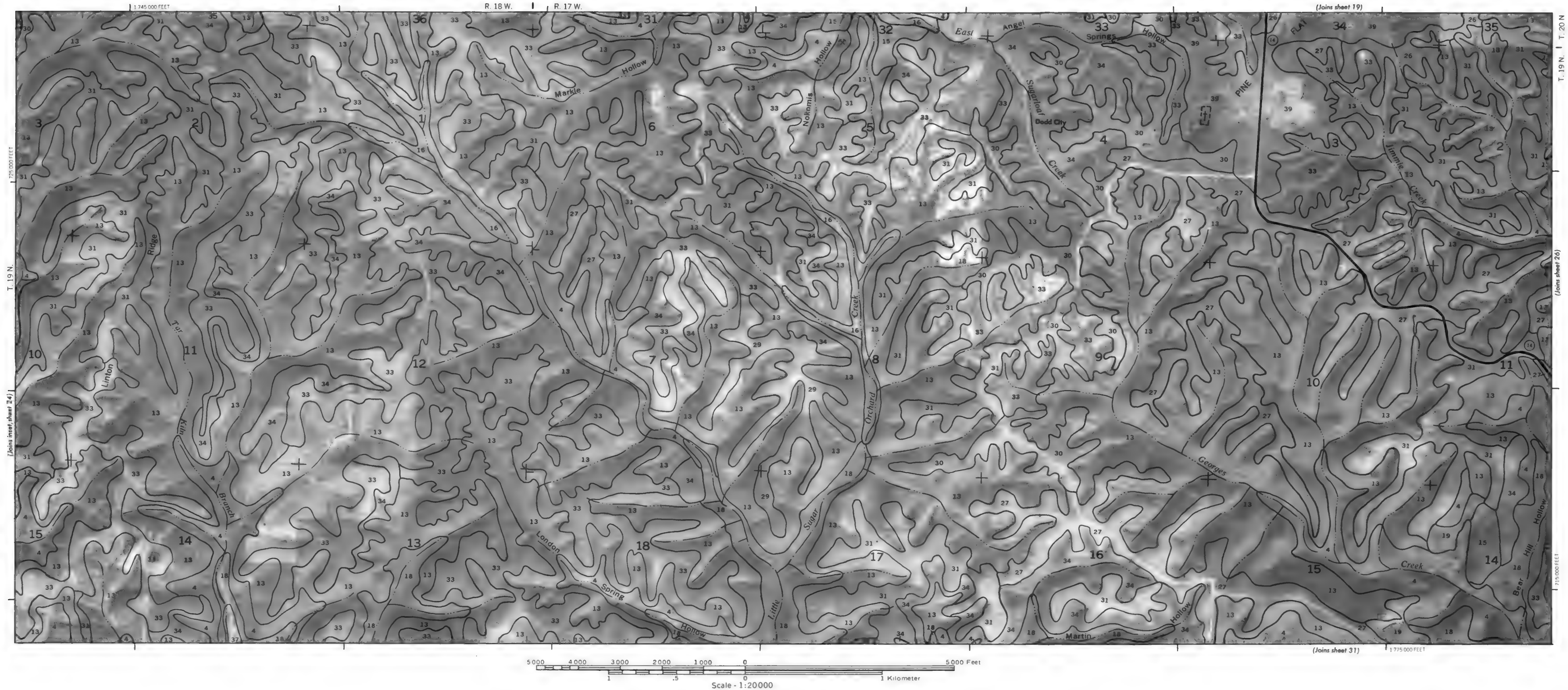
Scale 1:20 000

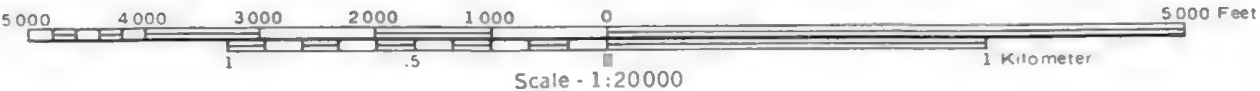
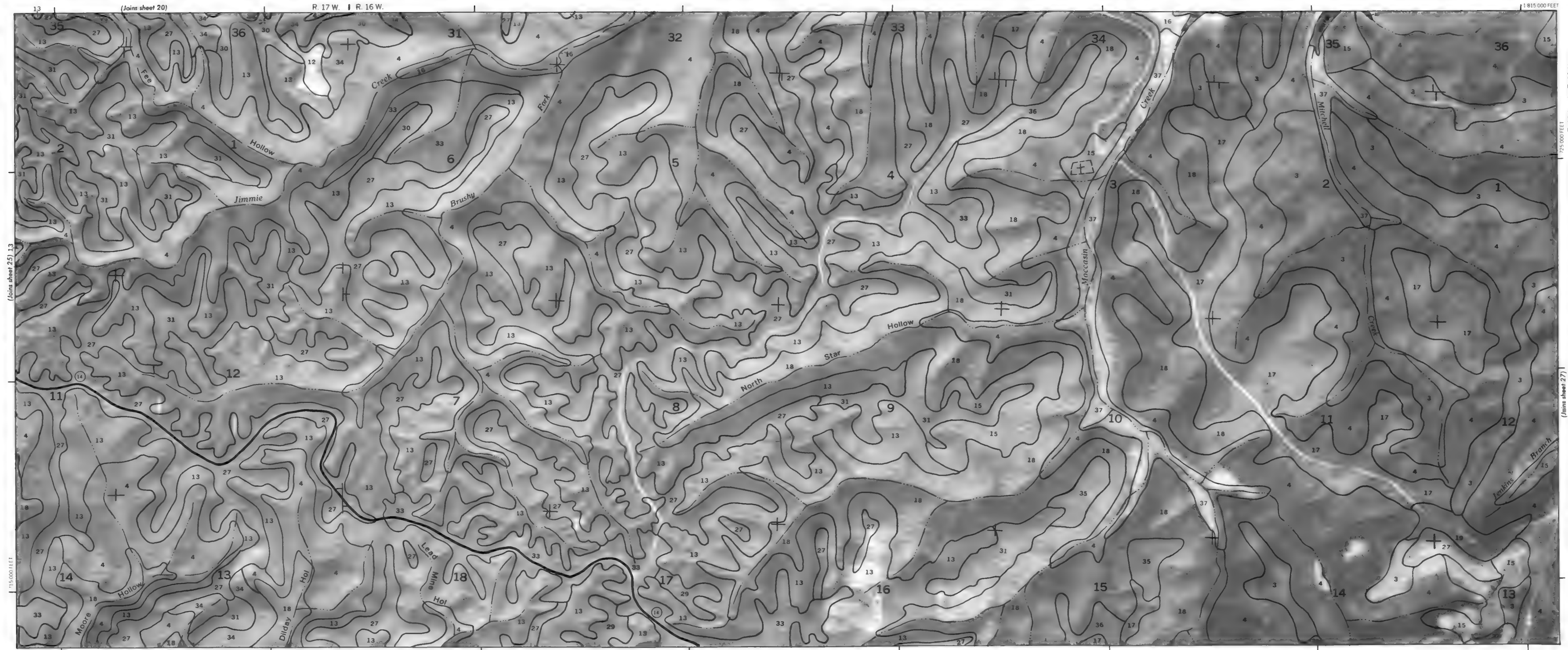
1 Kilometer



(Joins inset, sheet 30)

4 000 AND 5 000 FEET (GRID T. 19 N.)





T. 19 N. T. 20 N.

R. 16 W. | R. 15 W. 1:820,000 FEET

(Joins sheet 21)

T. 19 N. | T. 20 N. 1:725,000 FEET

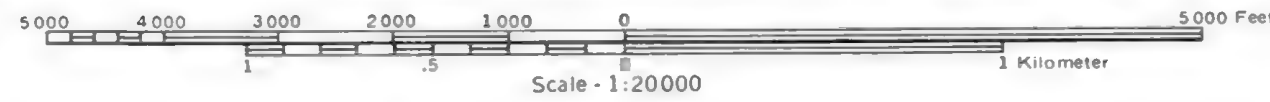
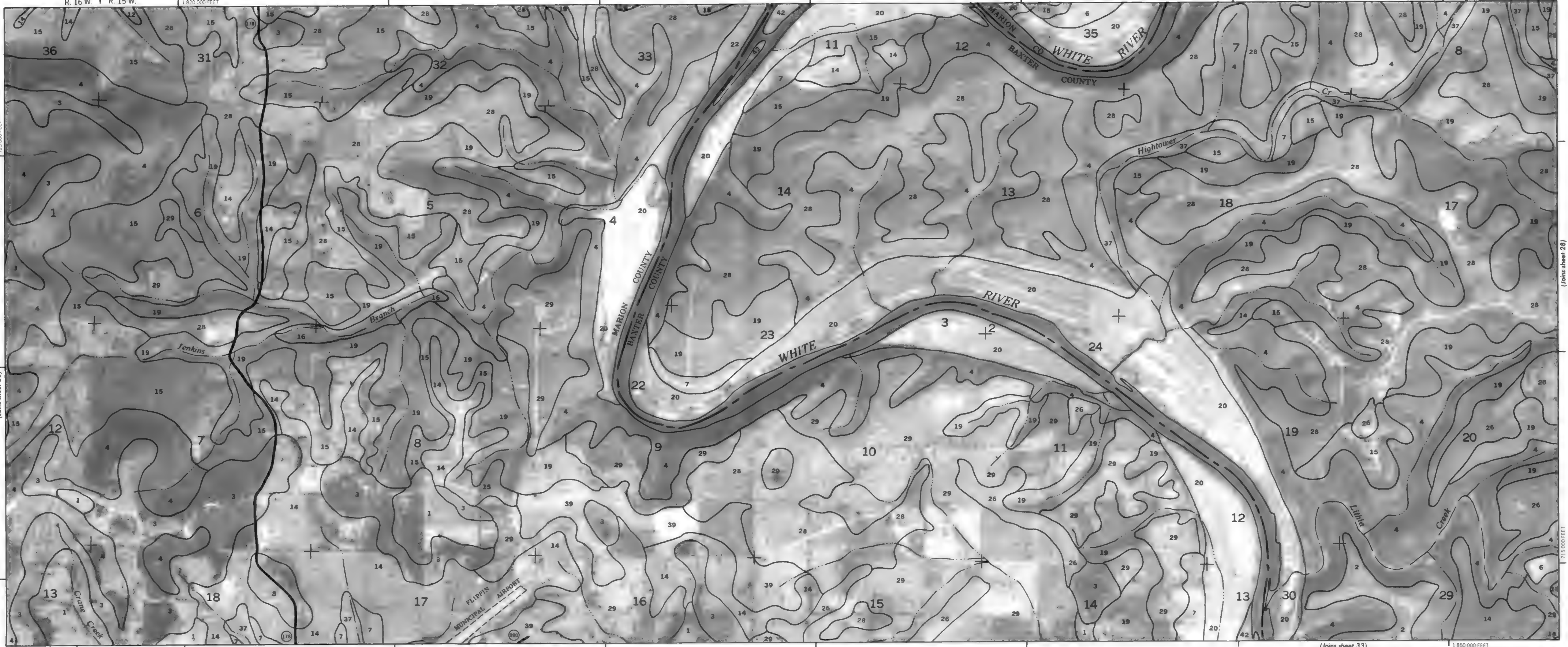
(Joins sheet 26)

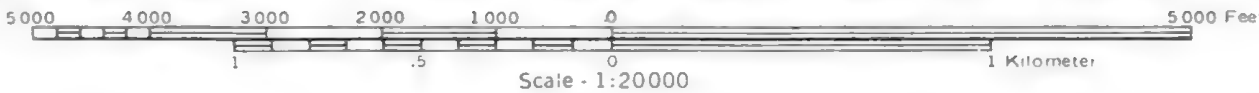
(Joins sheet 28)

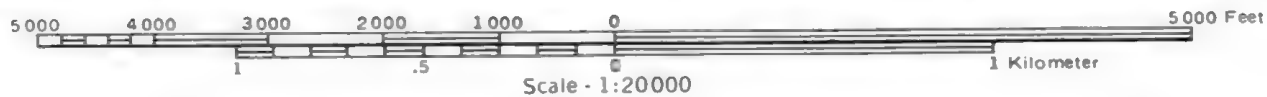
1:715,000 FEET

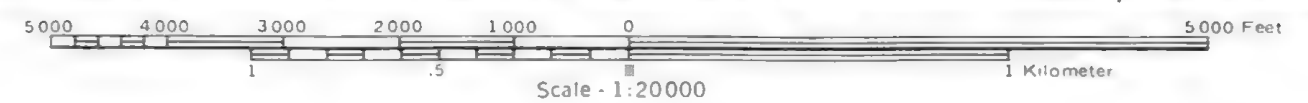
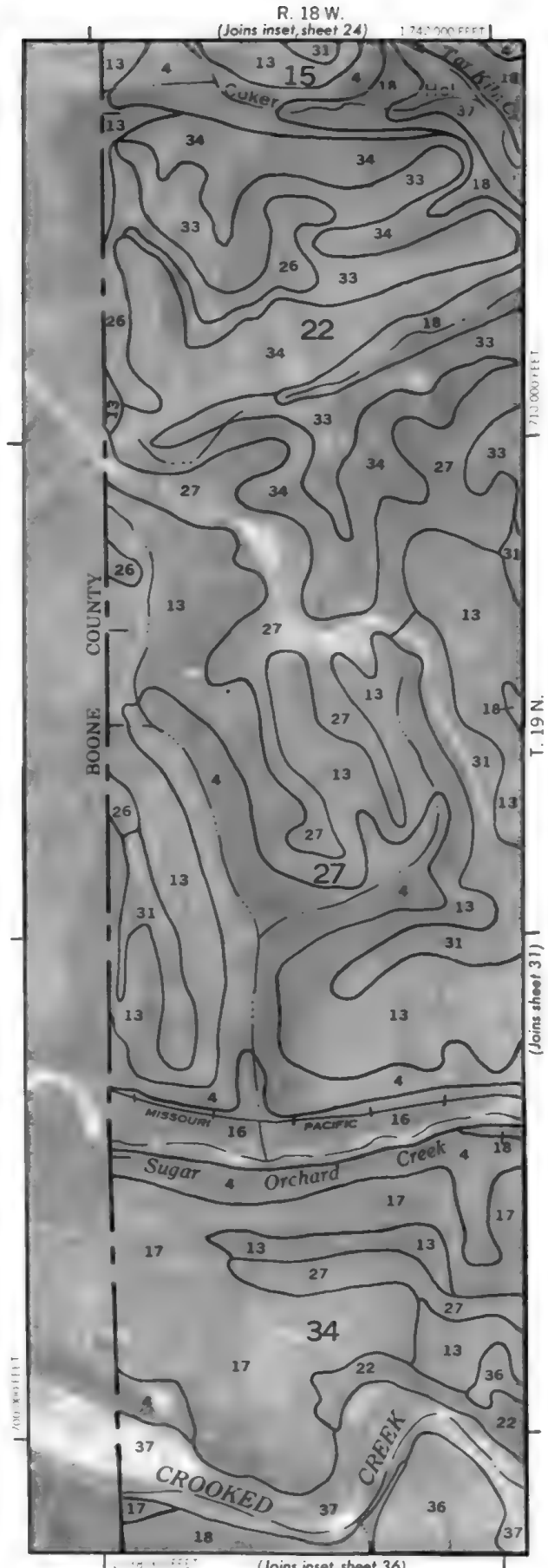
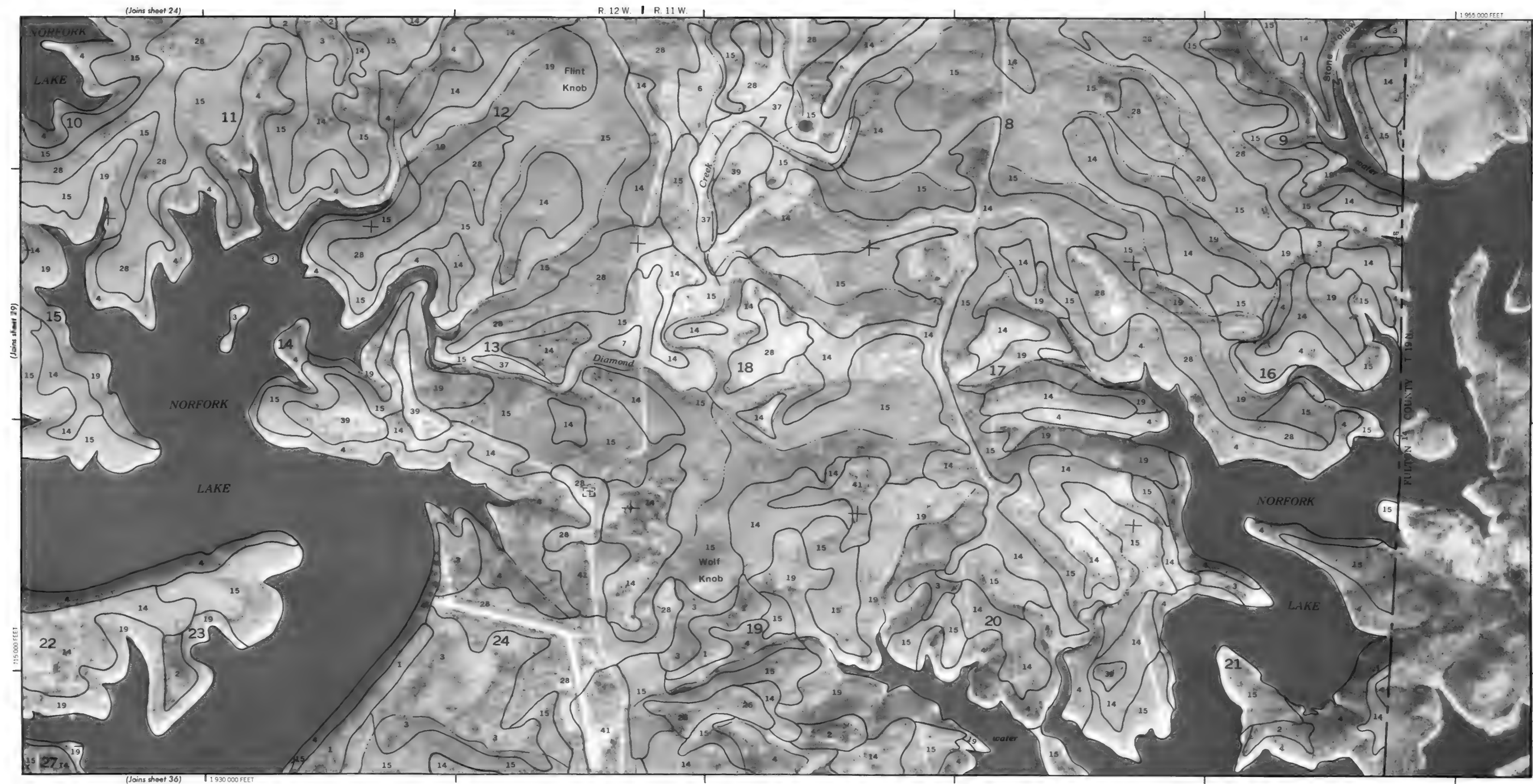
(Joins sheet 33)

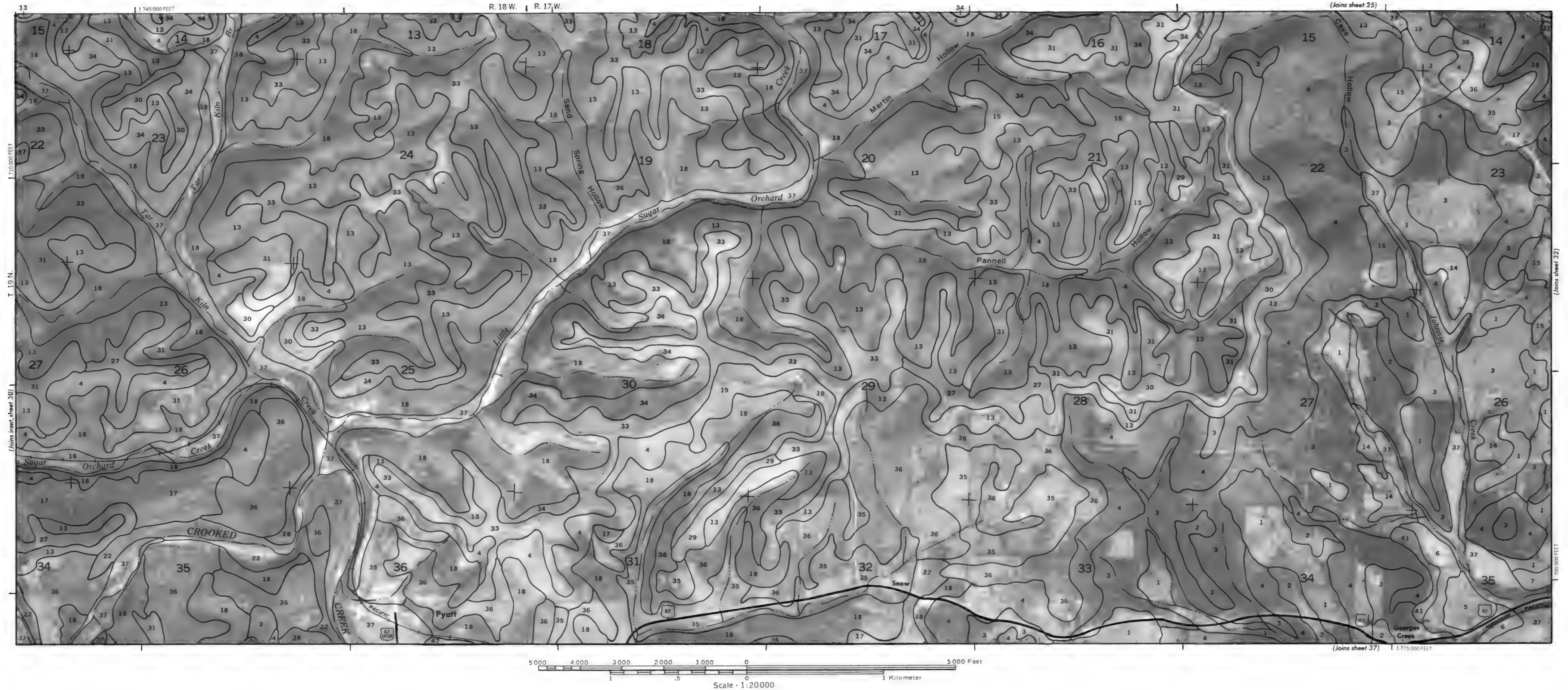
1:850,000 FEET

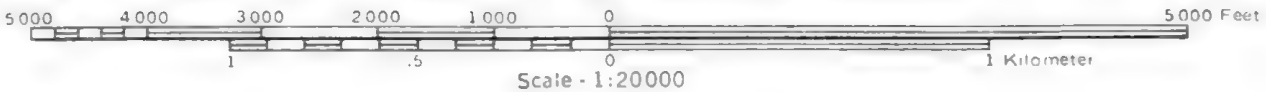
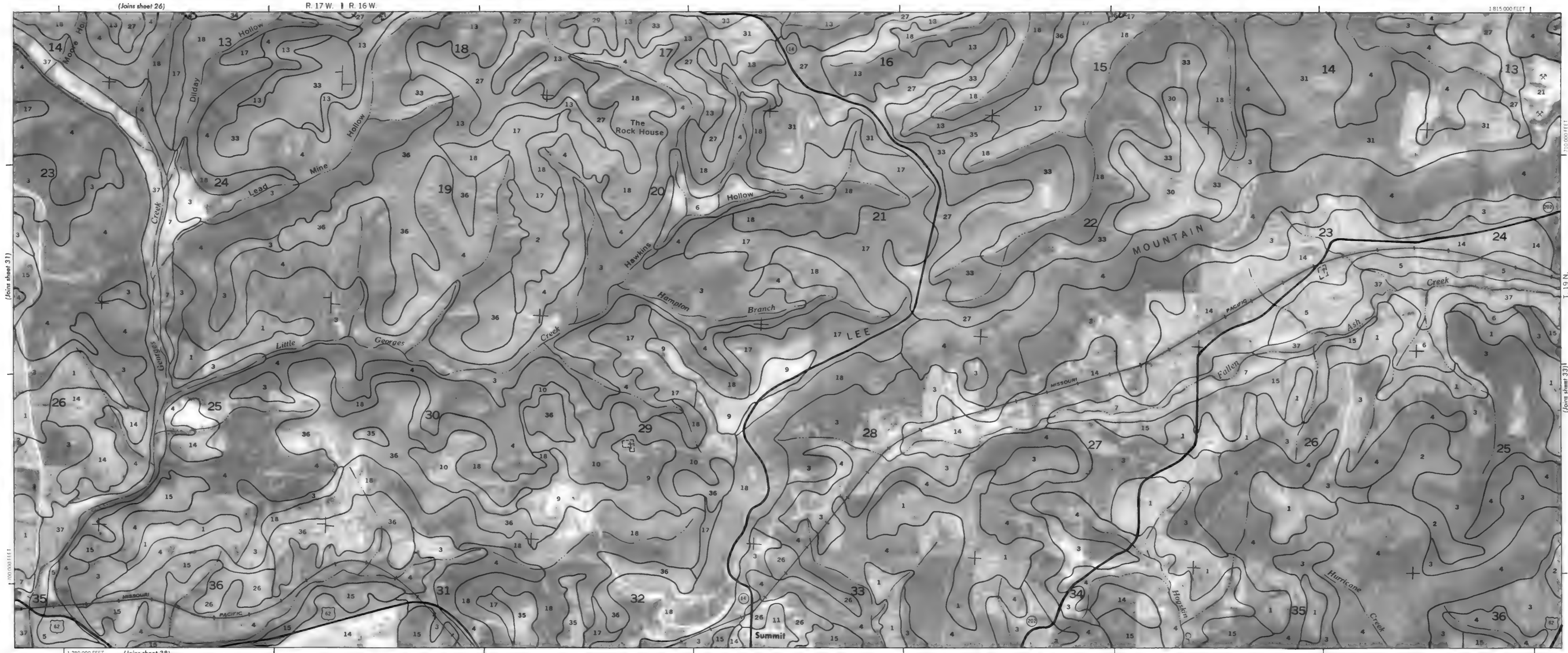




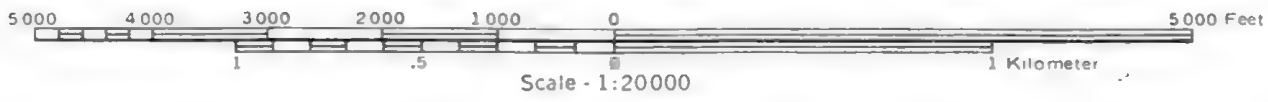
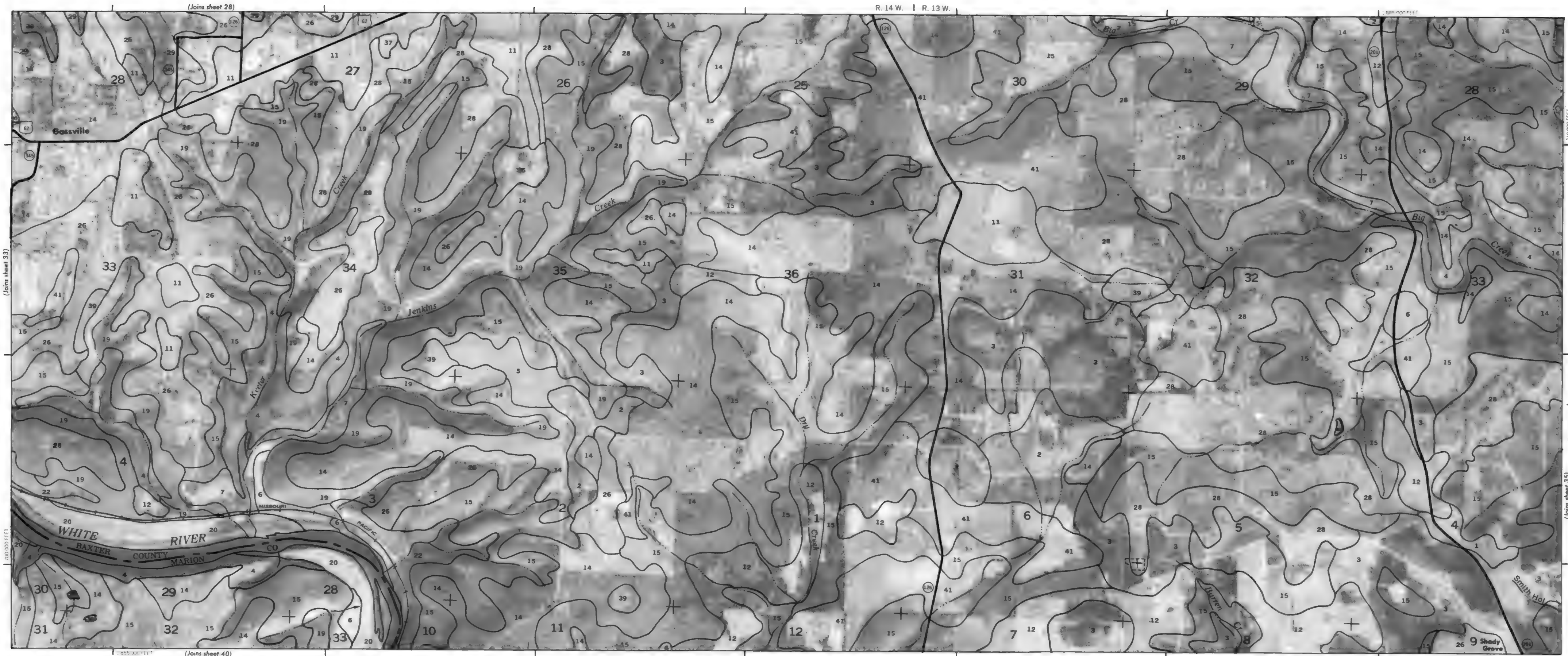


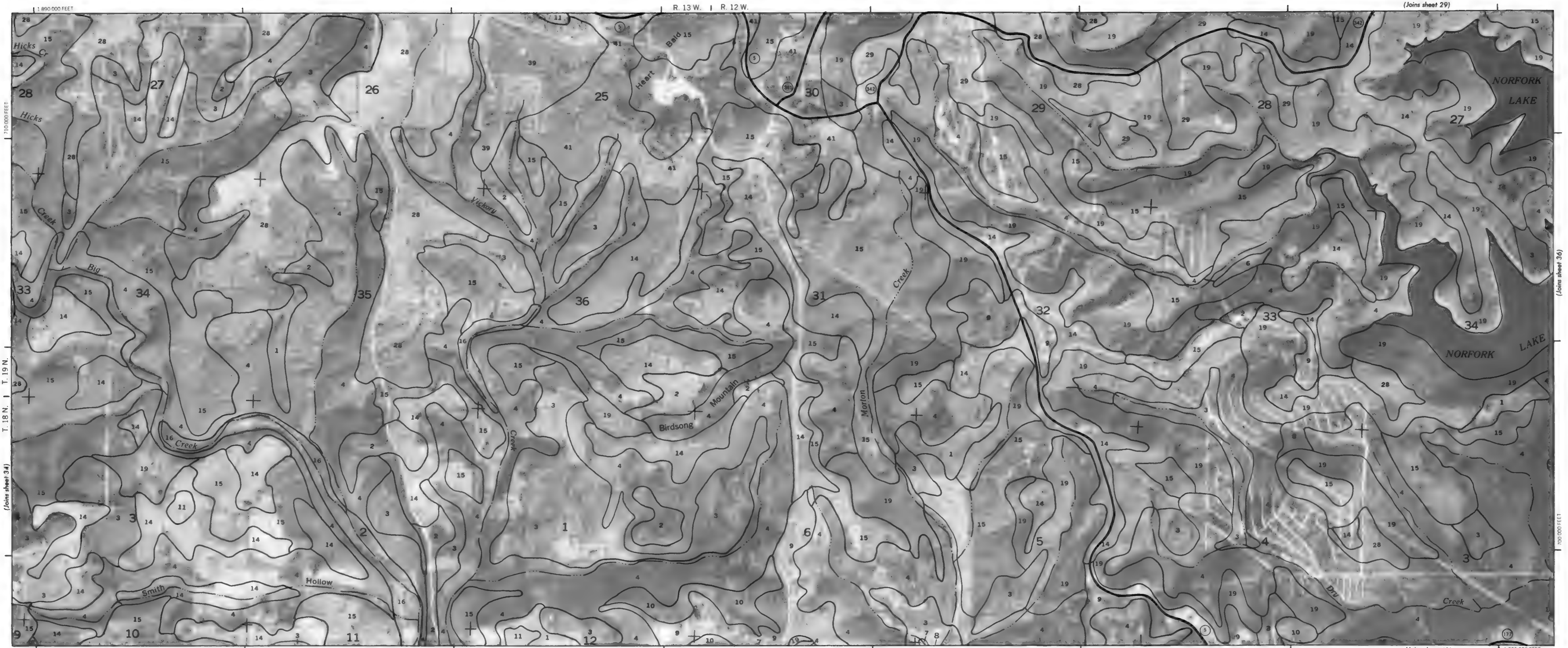












1:850 000 FEET

R. 13 W. | R. 12 W.

(Joins sheet 29)

710 000 FEET

T. 18 N. | T. 19 N.

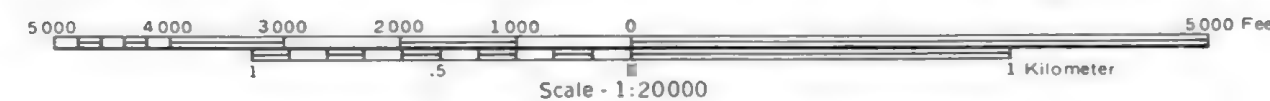
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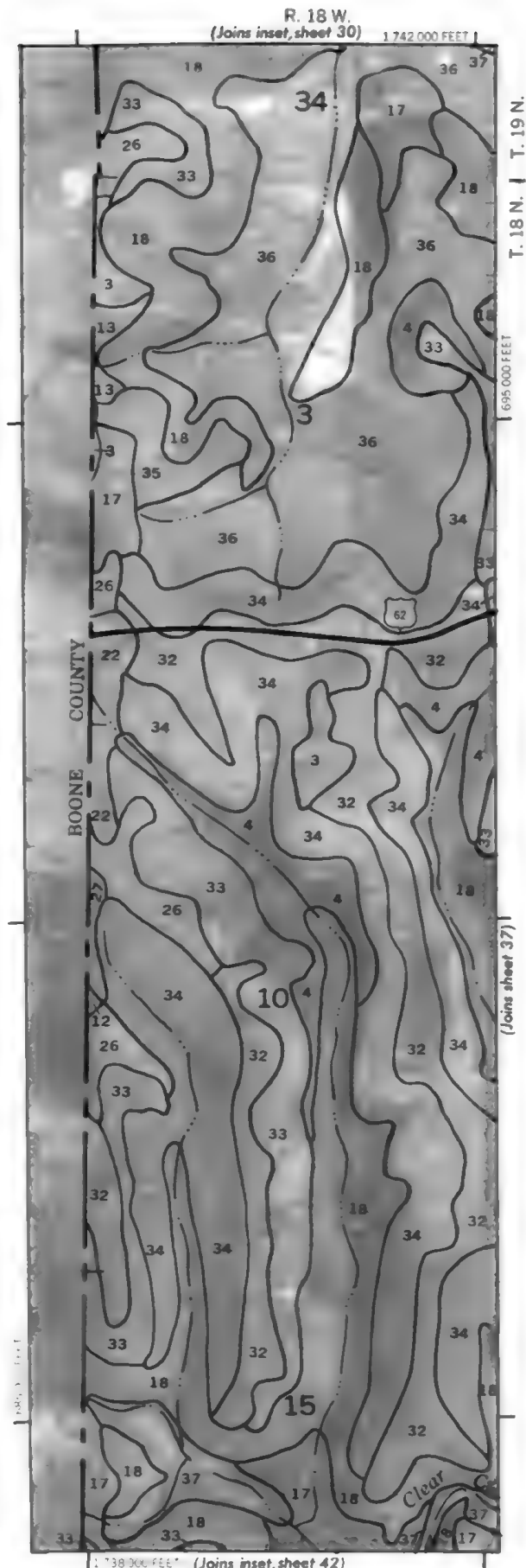
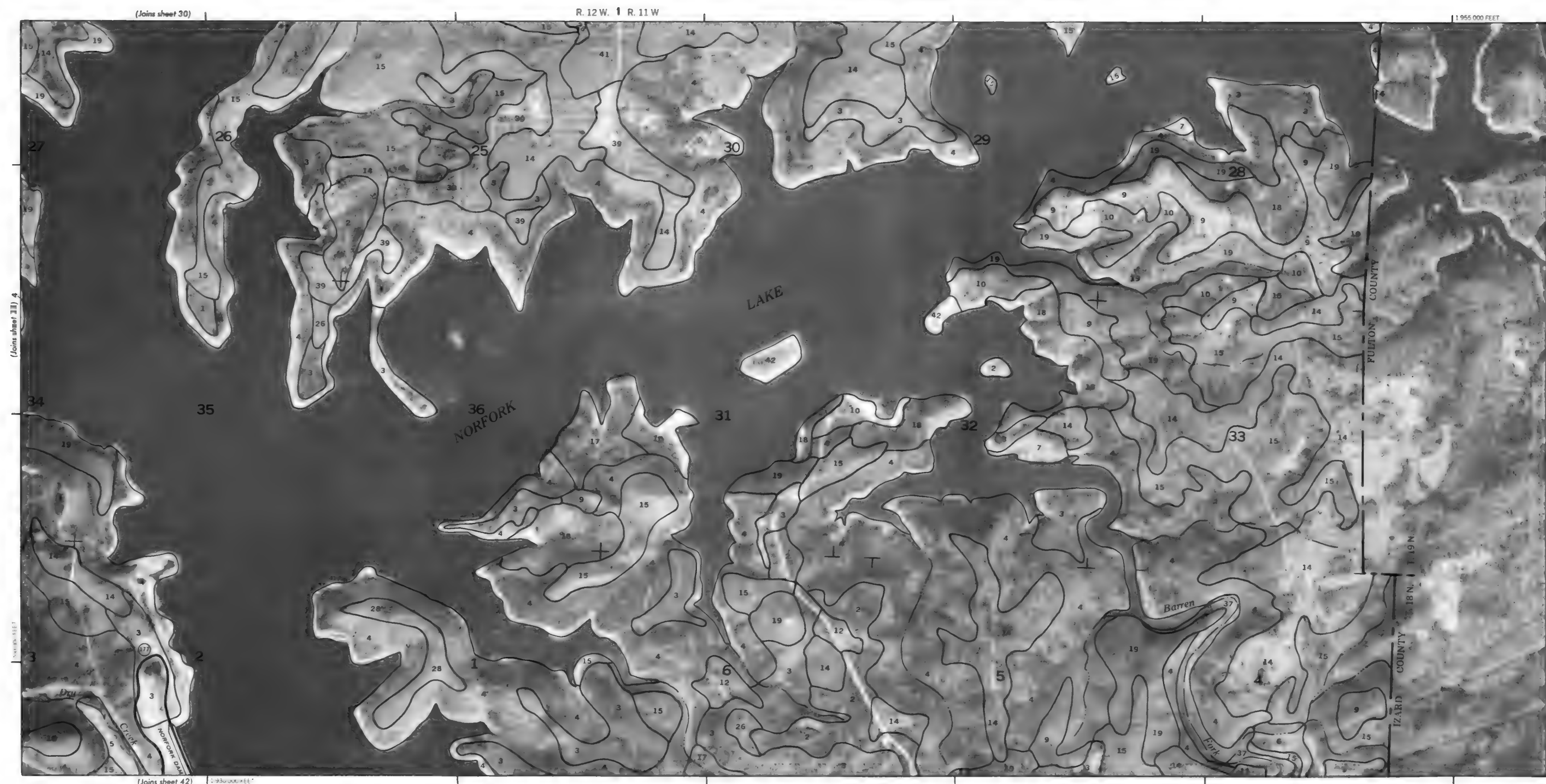
(Joins sheet 36)

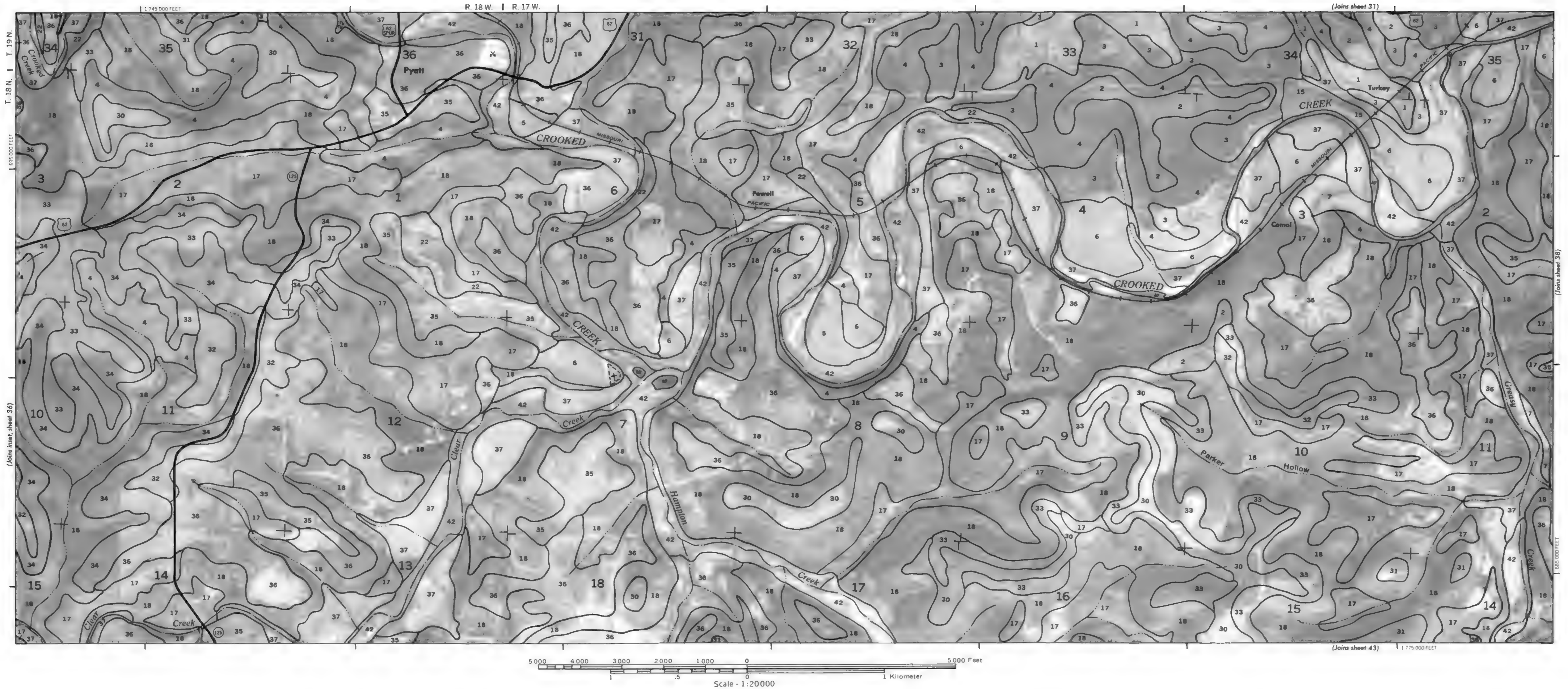
710 000 FEET

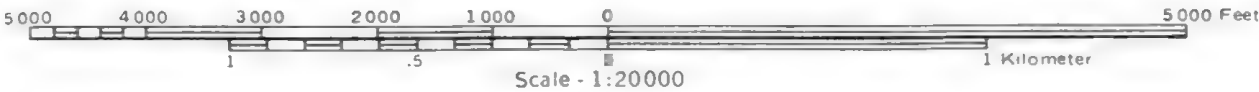
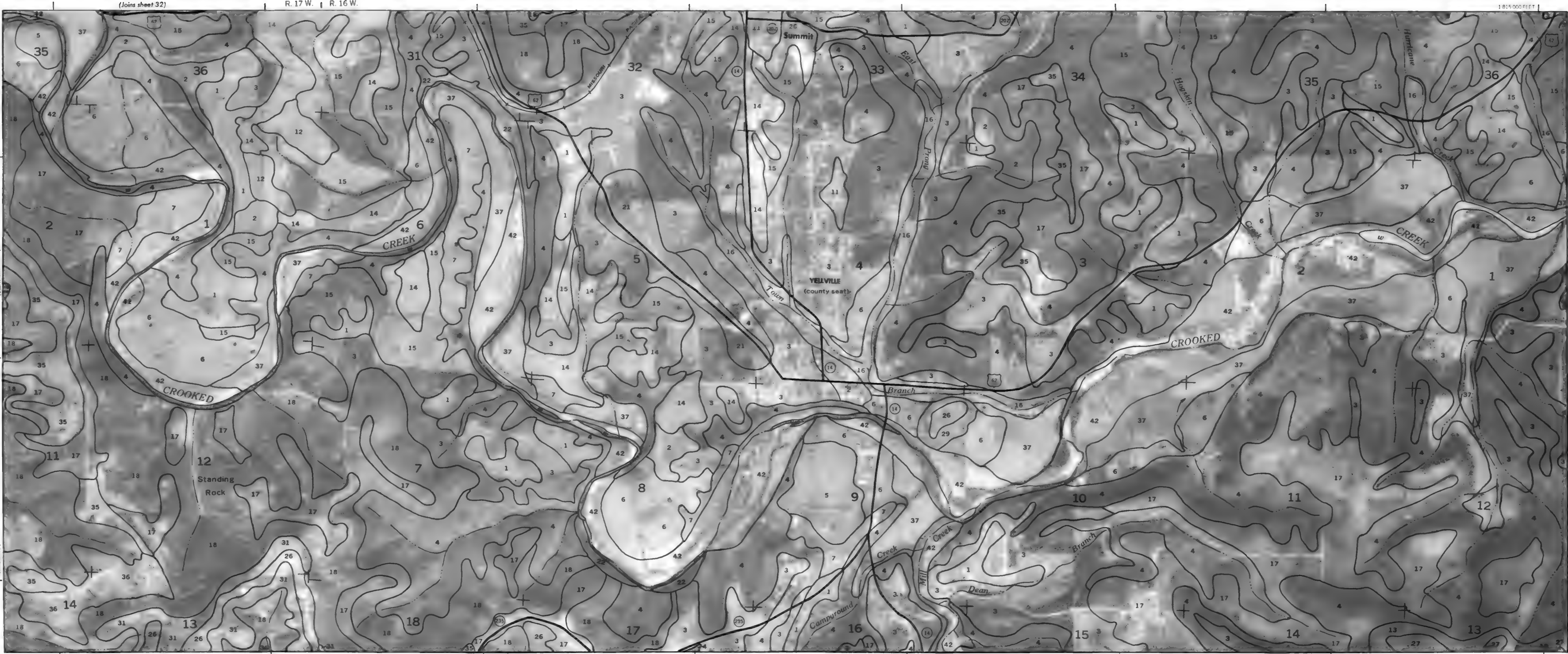
(Joins sheet 41)

1:925 000 FEET









R. 16 W. | R. 15 W.

1:820 000 FEET

(Joins sheet 33)

R. 15 W. | R. 14 W.

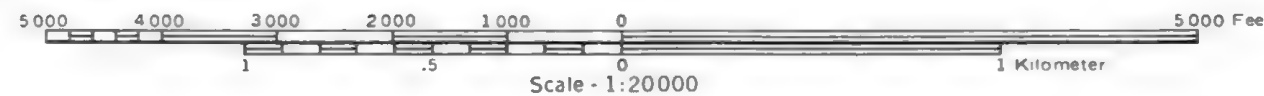
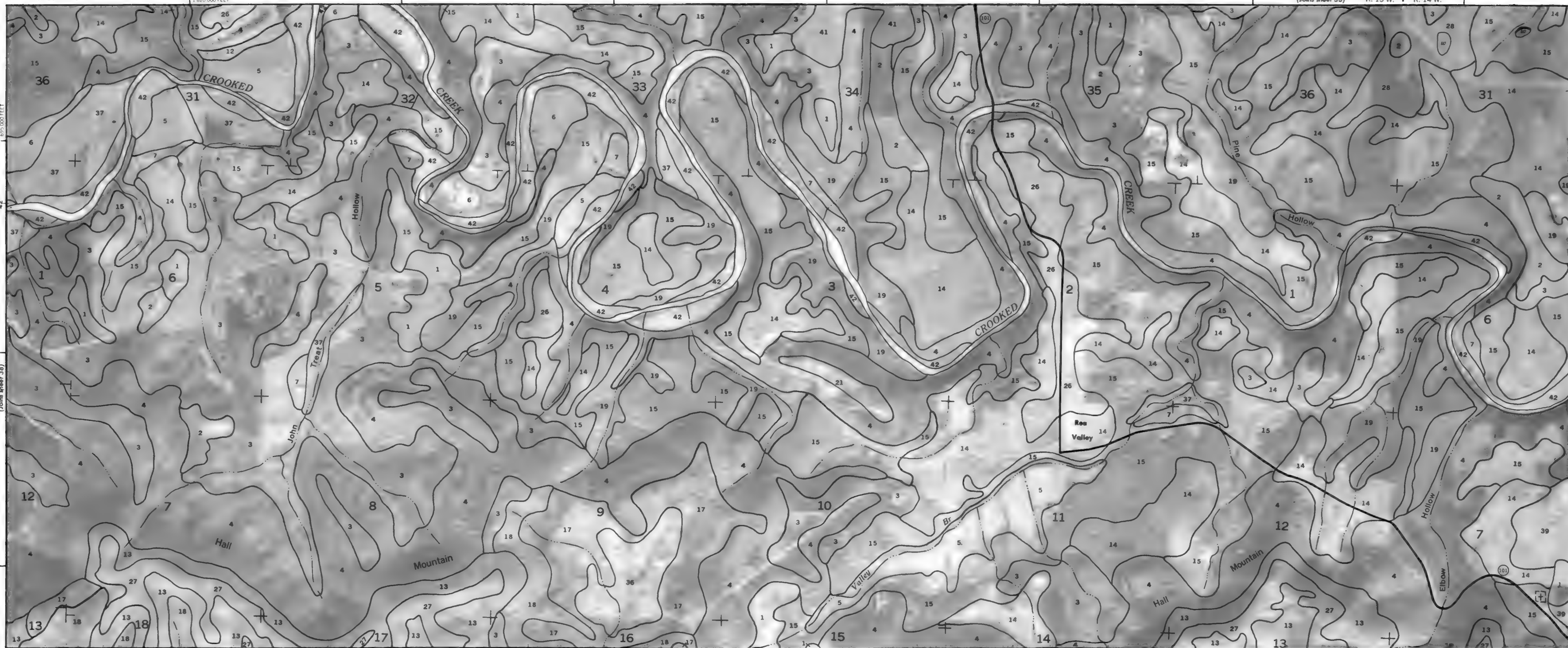


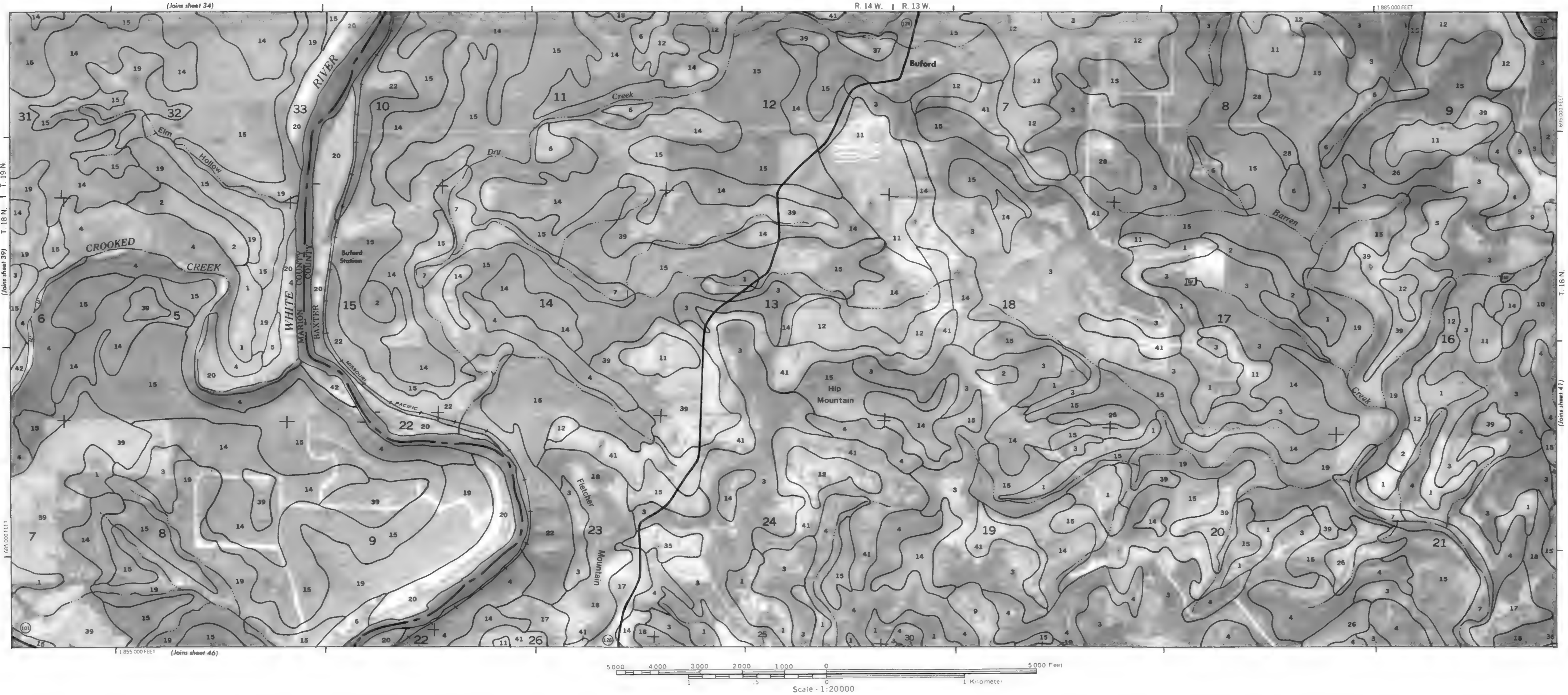
T. 18 N. | T. 19 N.

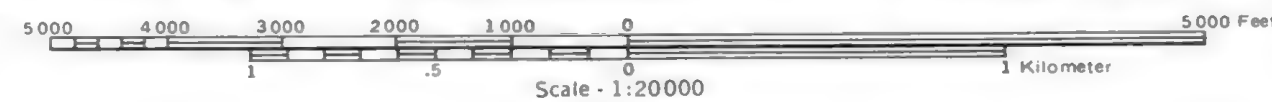
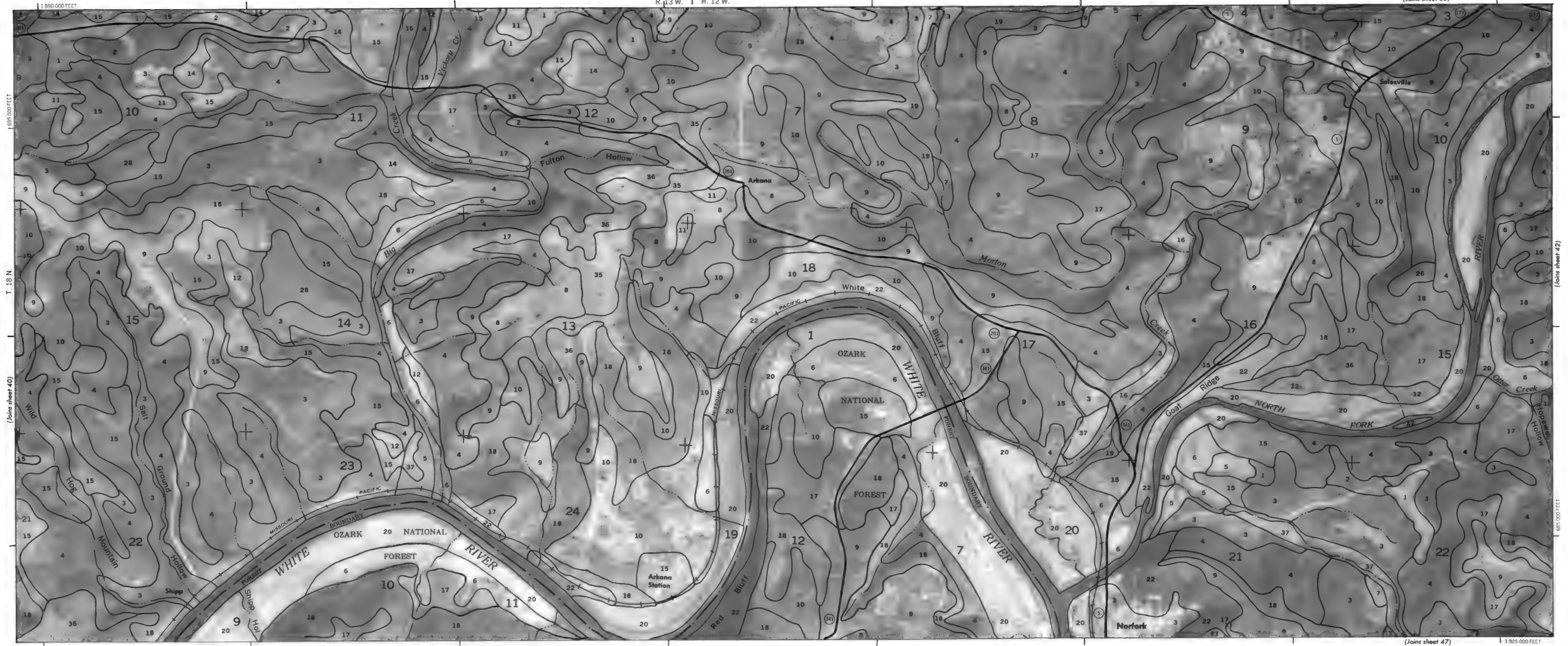
(Joins sheet 38)

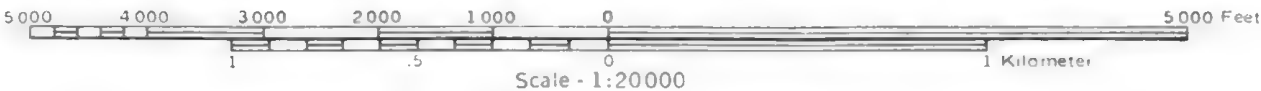
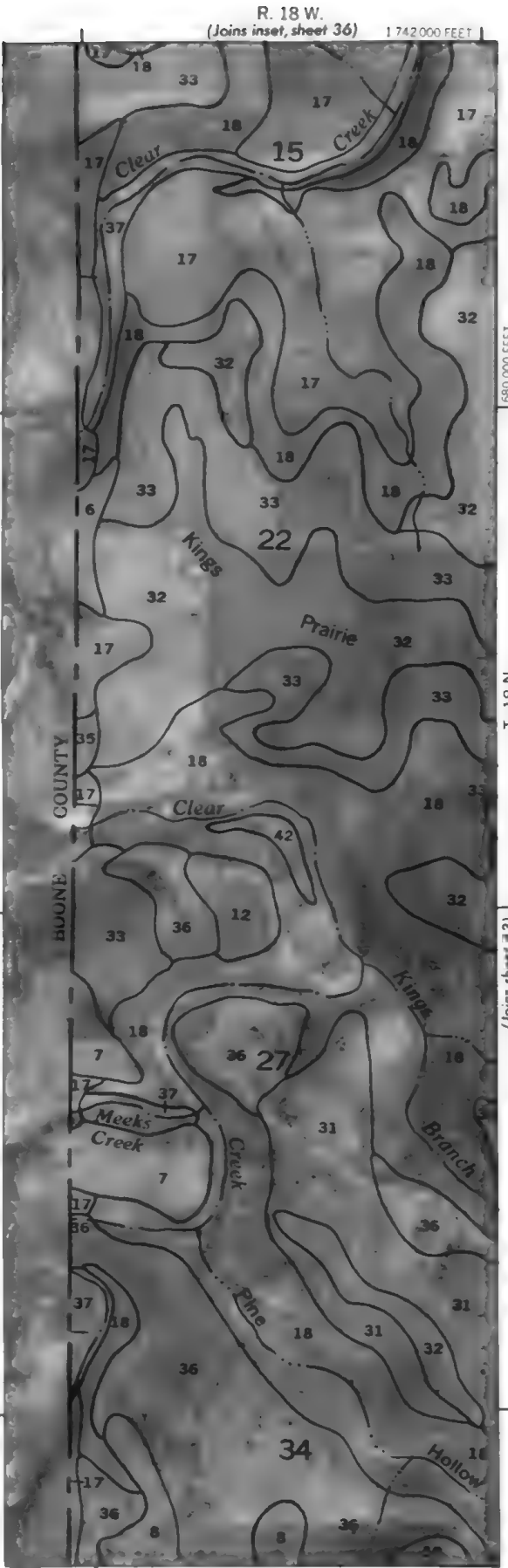
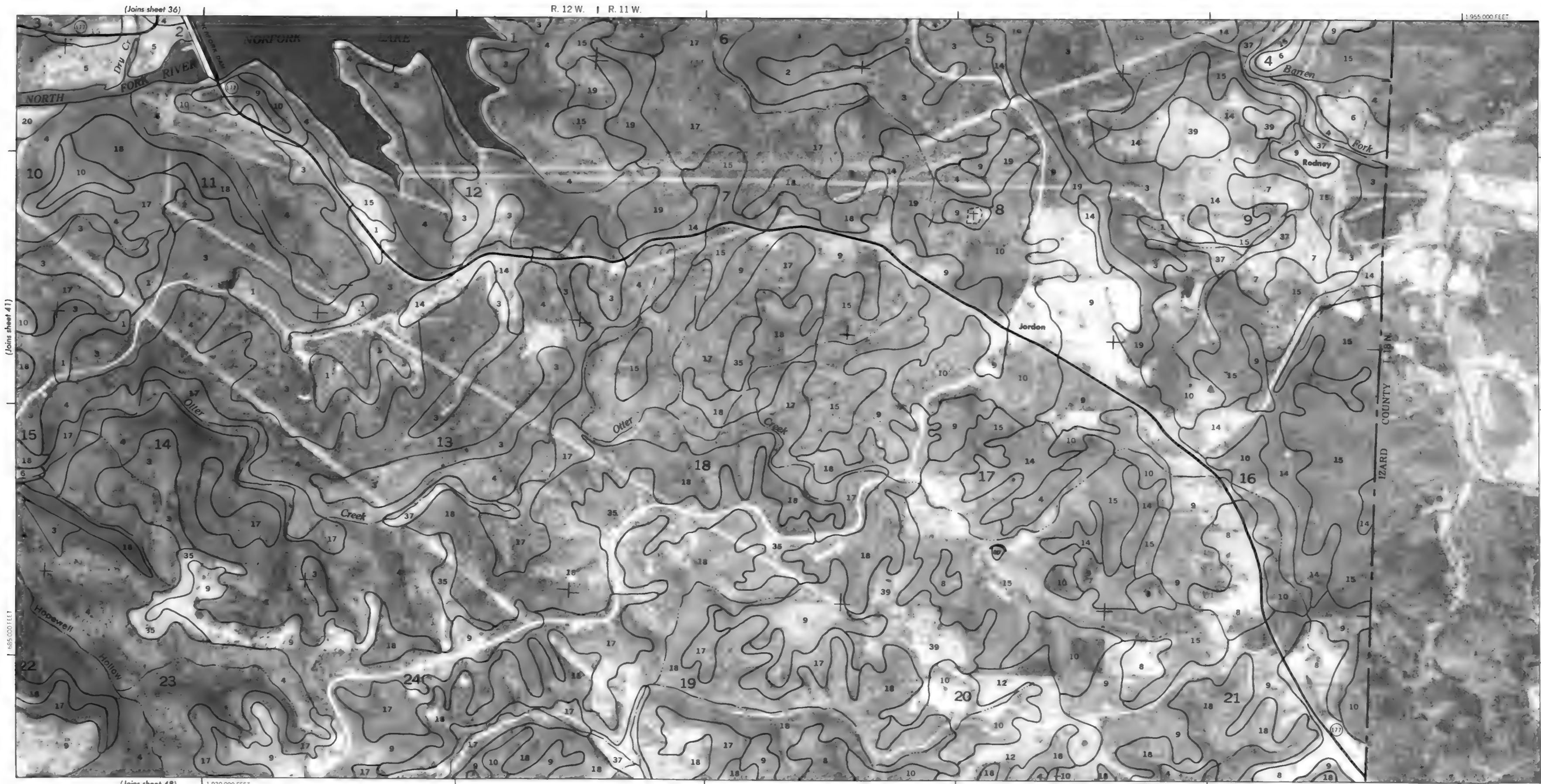
(Joins sheet 40)

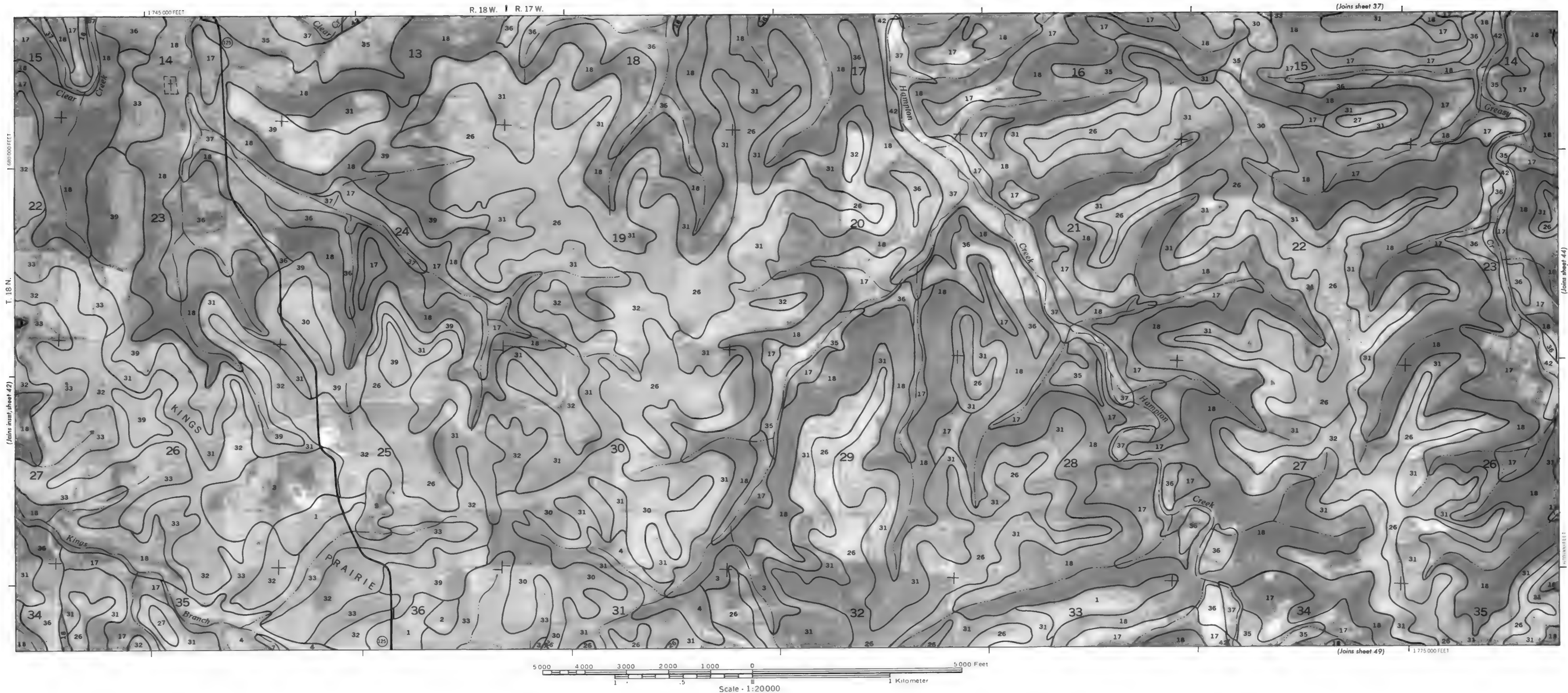
685 000 FEET

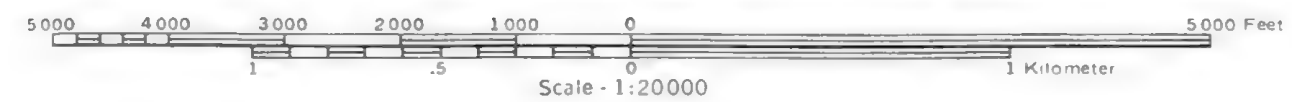
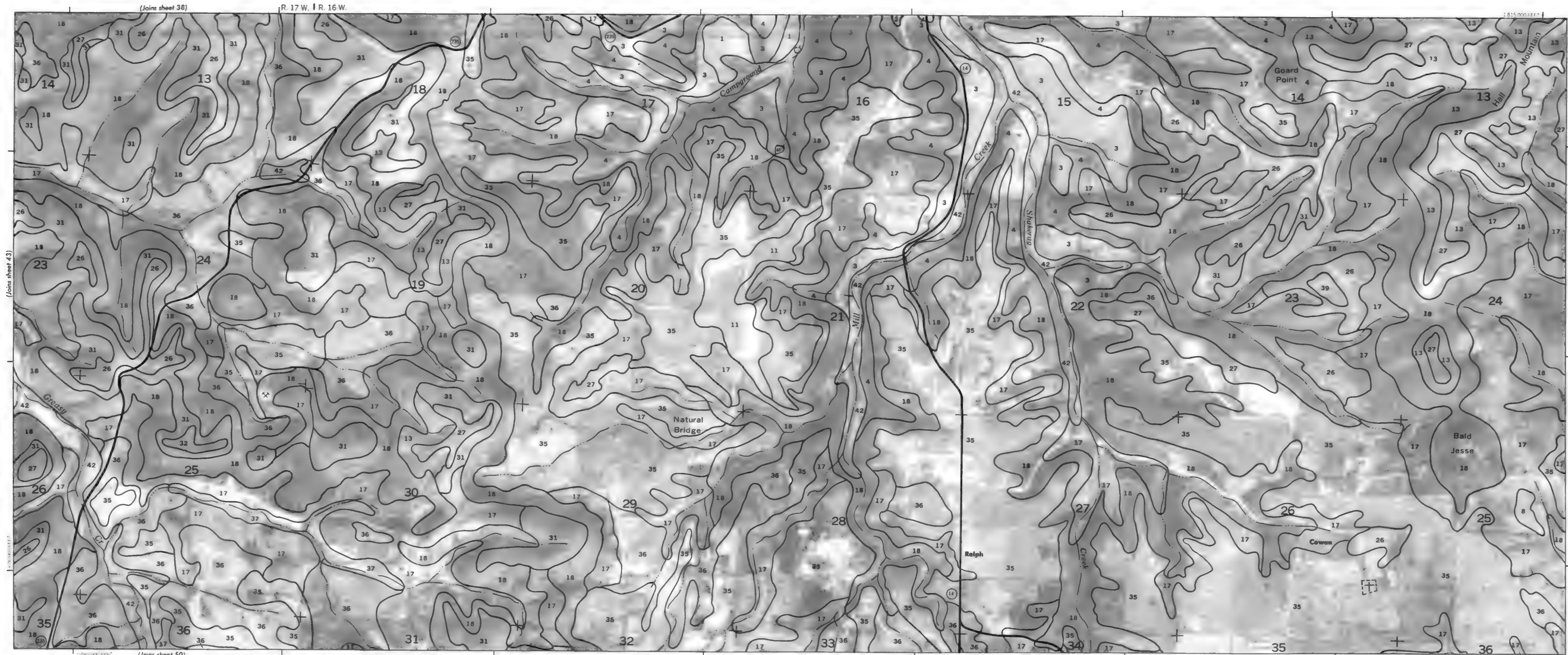


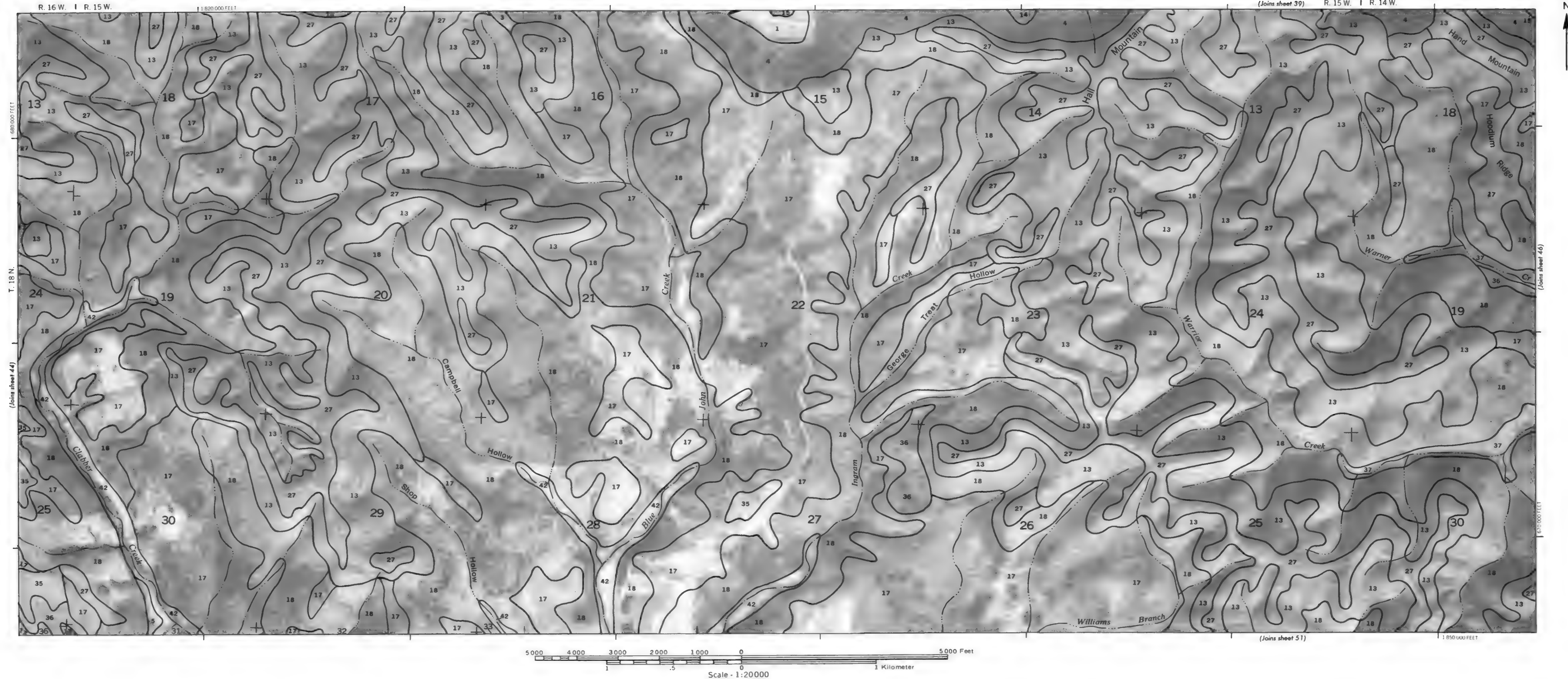










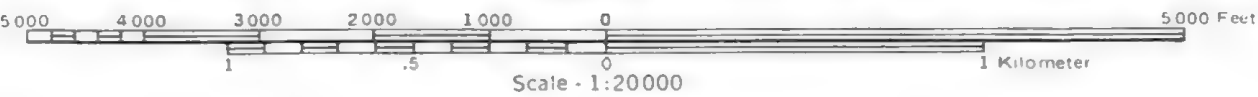
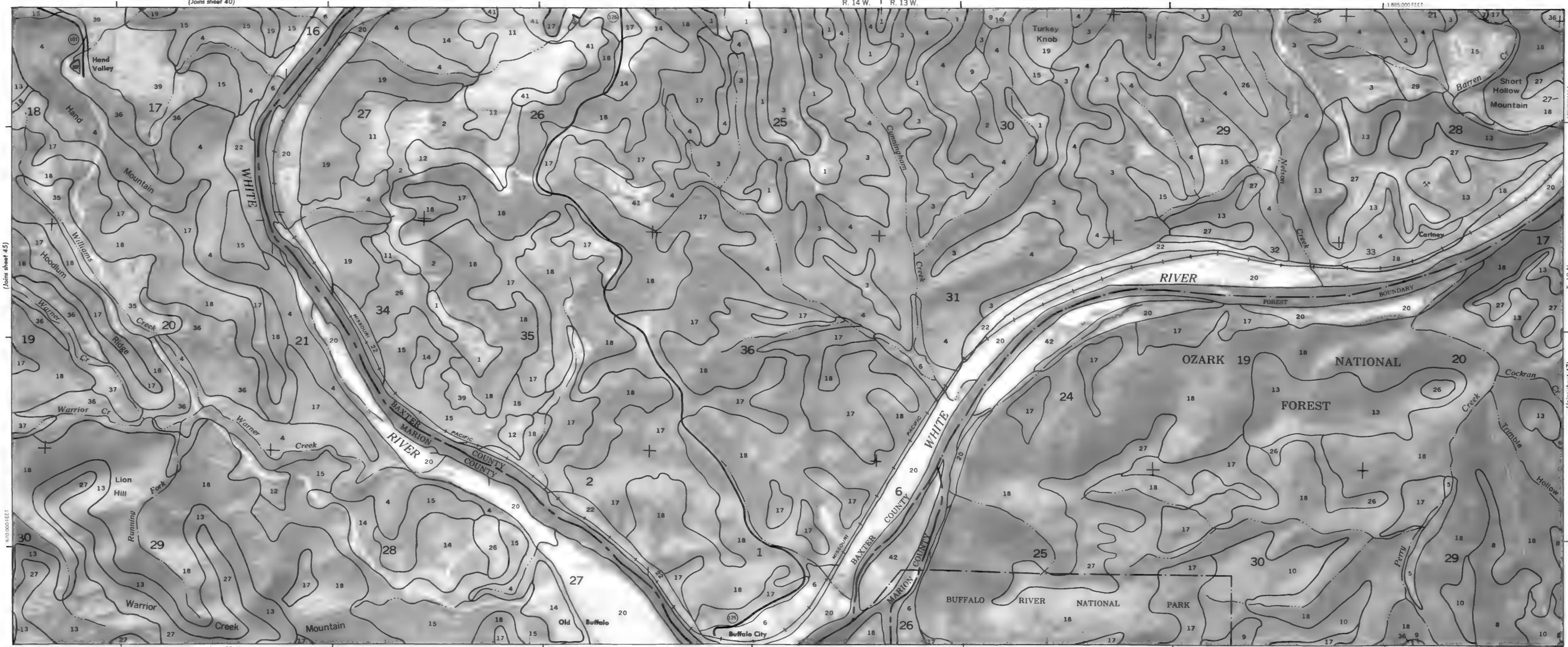


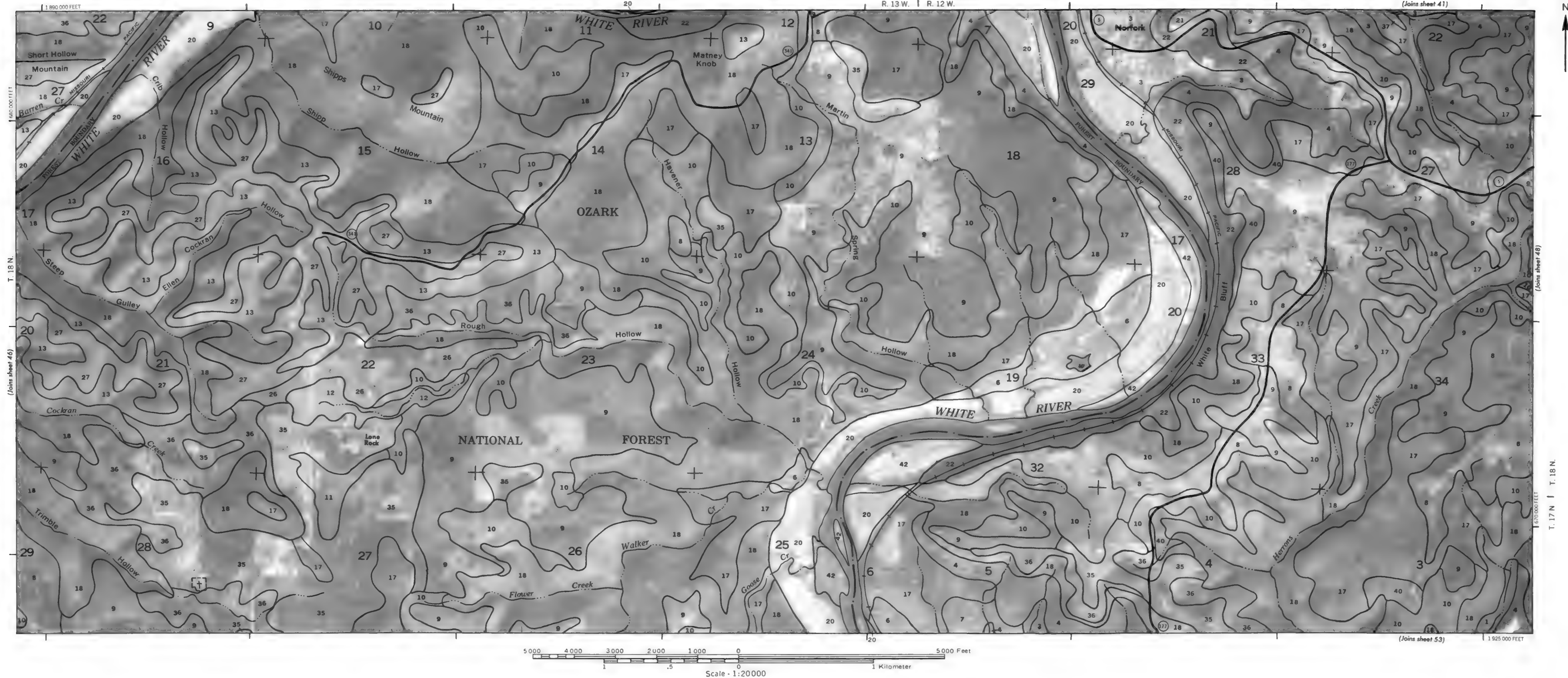
R. 14 W. | R. 13 W.

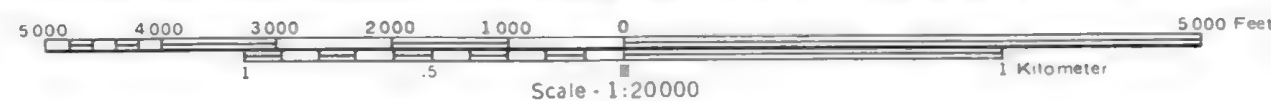
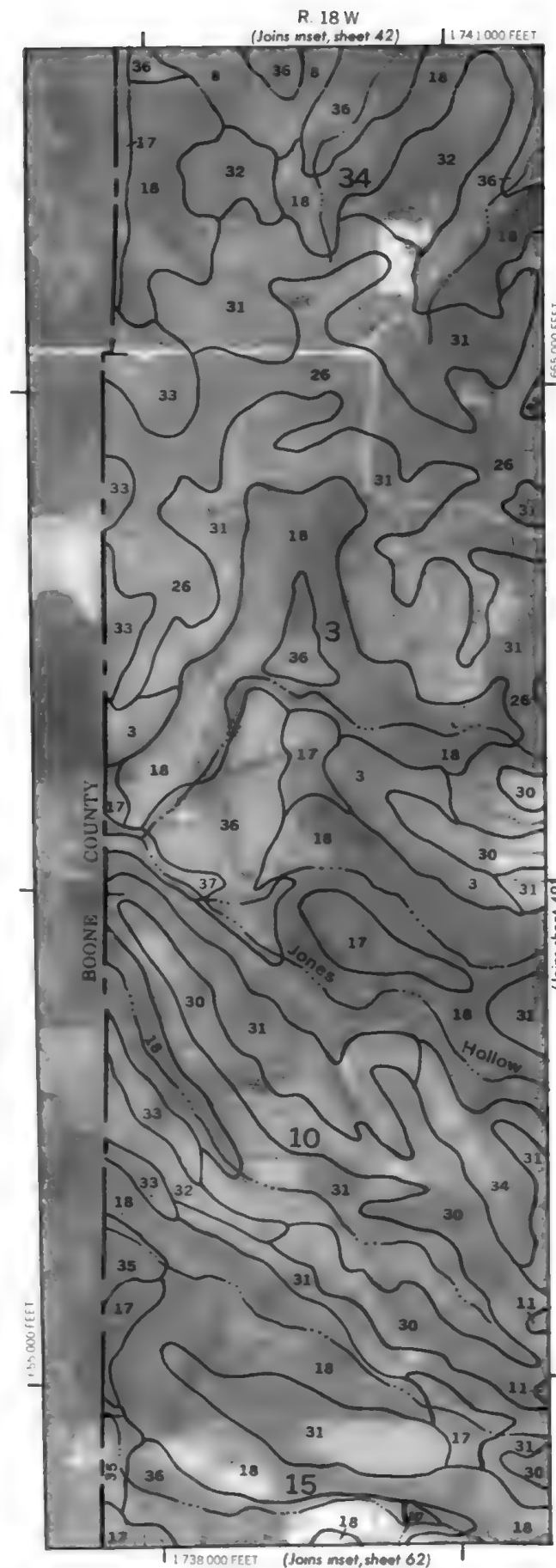
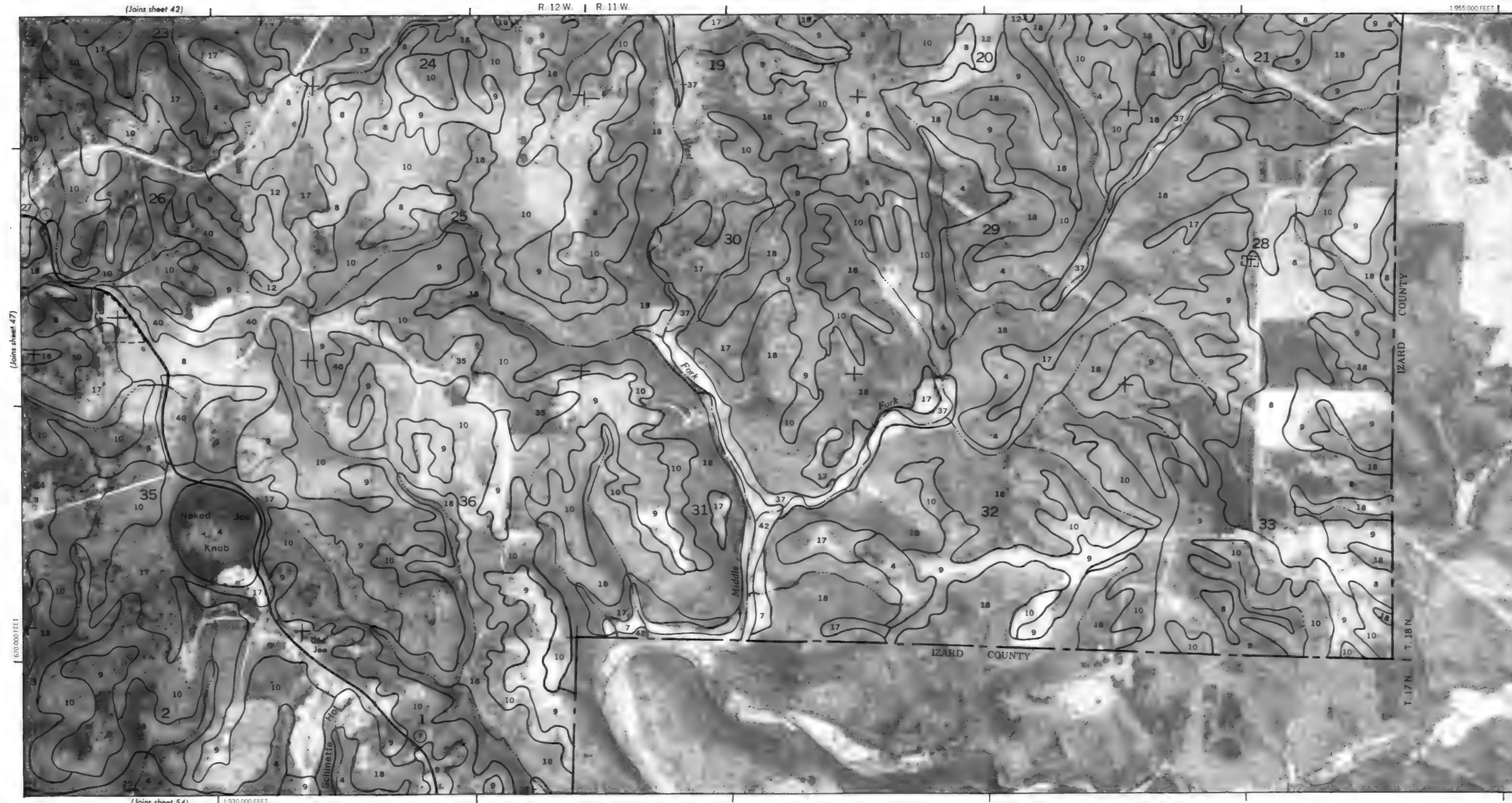
1:855,000 FEET

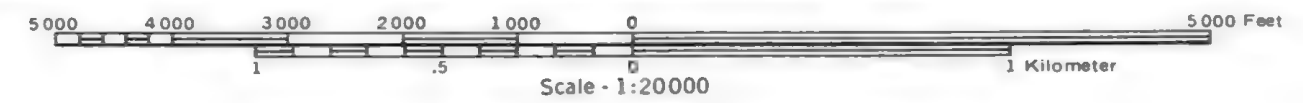
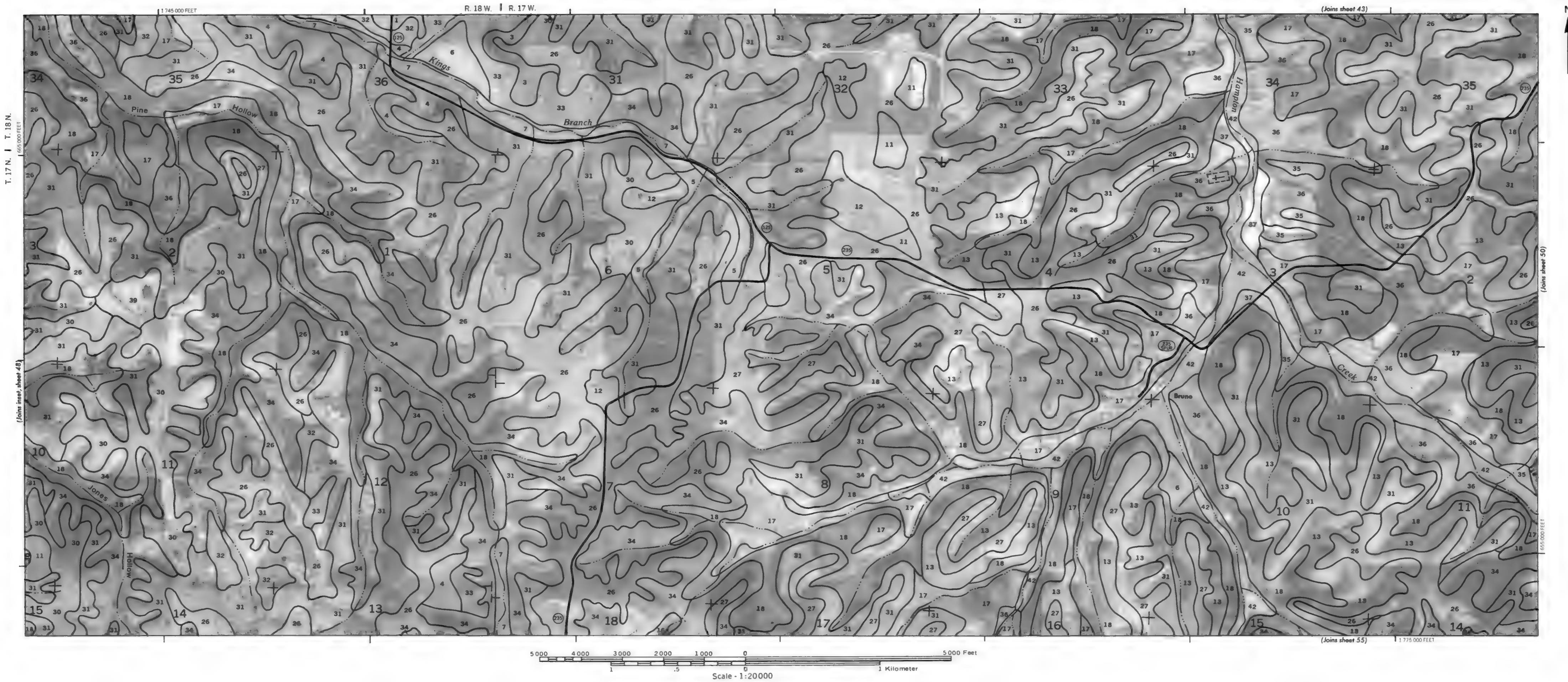
(Joins sheet 40)

(Joins sheet 52)





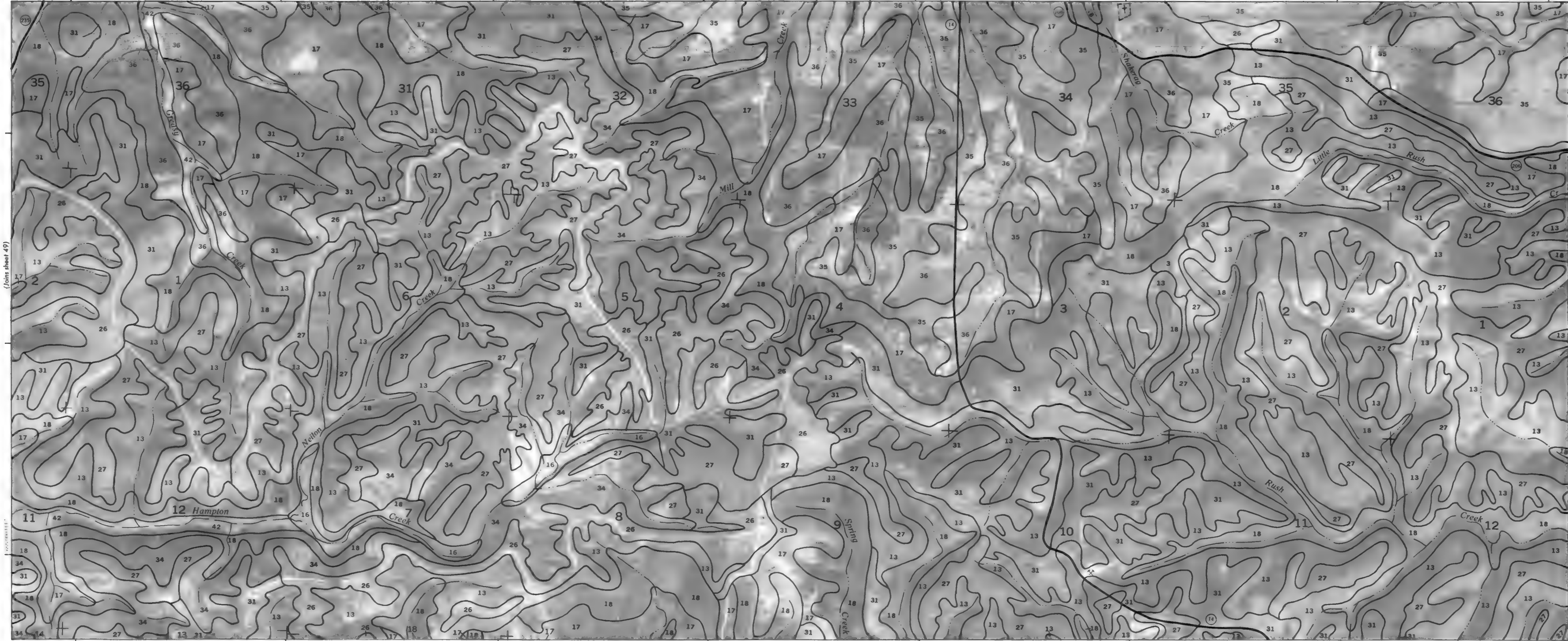




R. 17 W. | R. 16 W.

(Joins sheet 44)

1:625,000 FEET

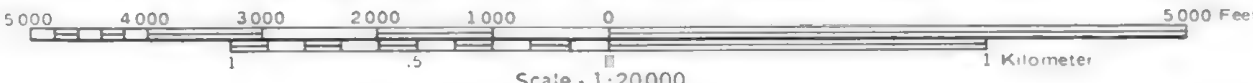


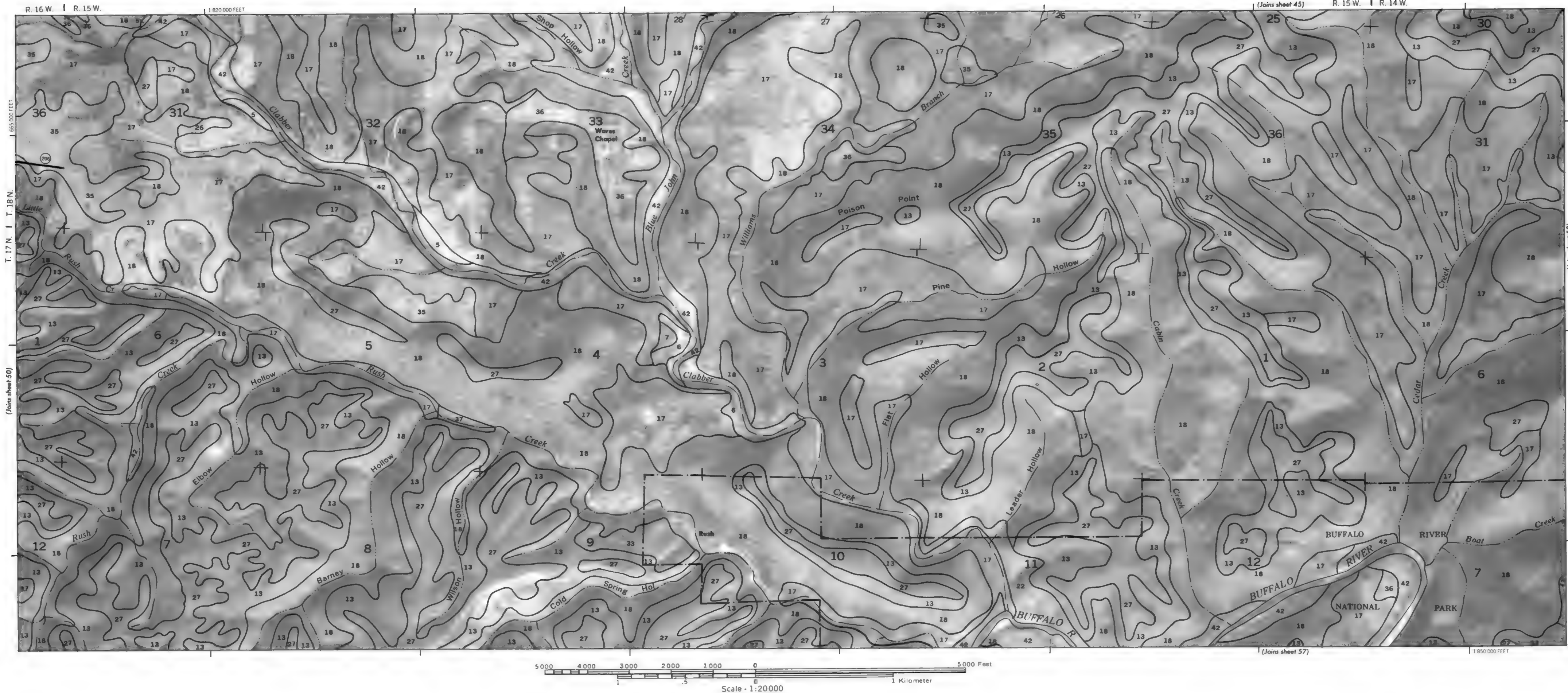
(Joins sheet 49)

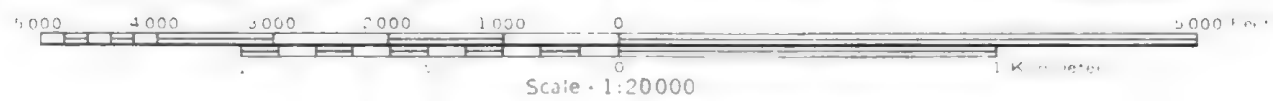
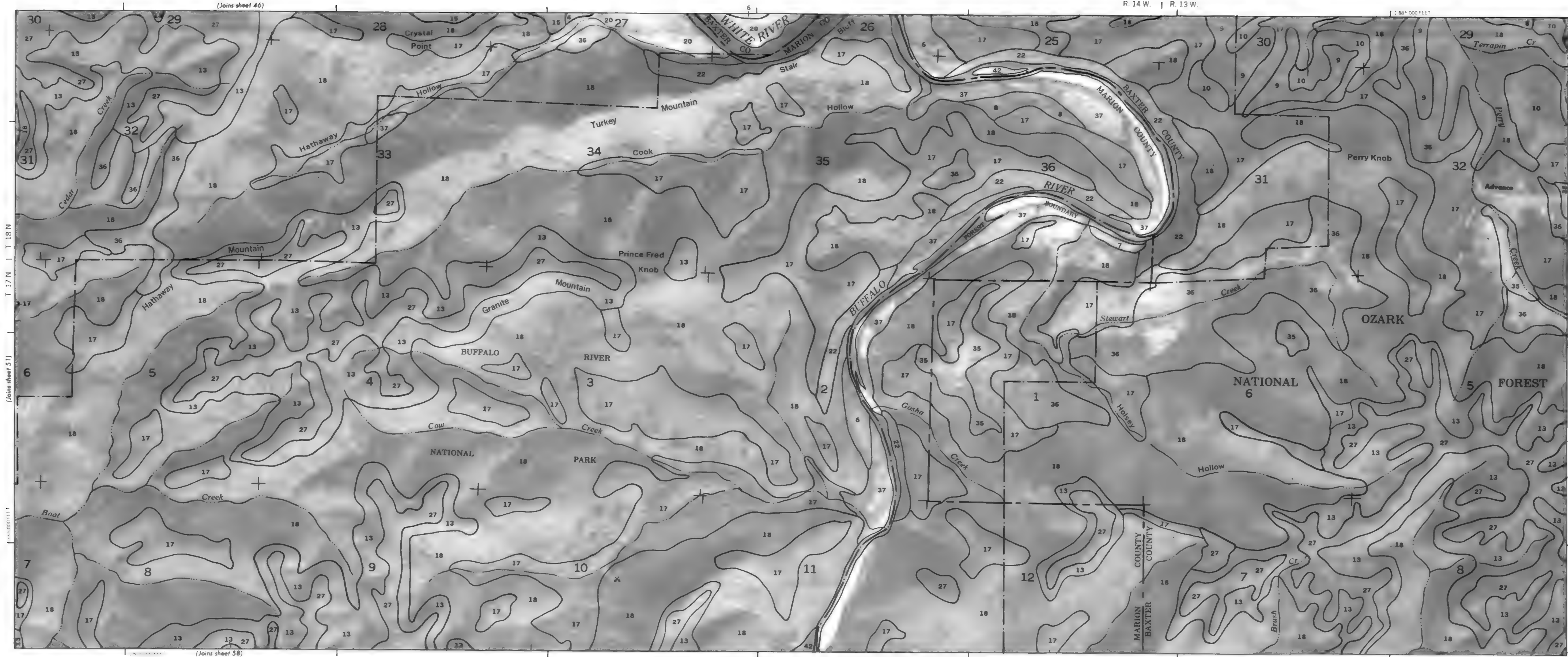
T. 17 N. | T. 18 N.

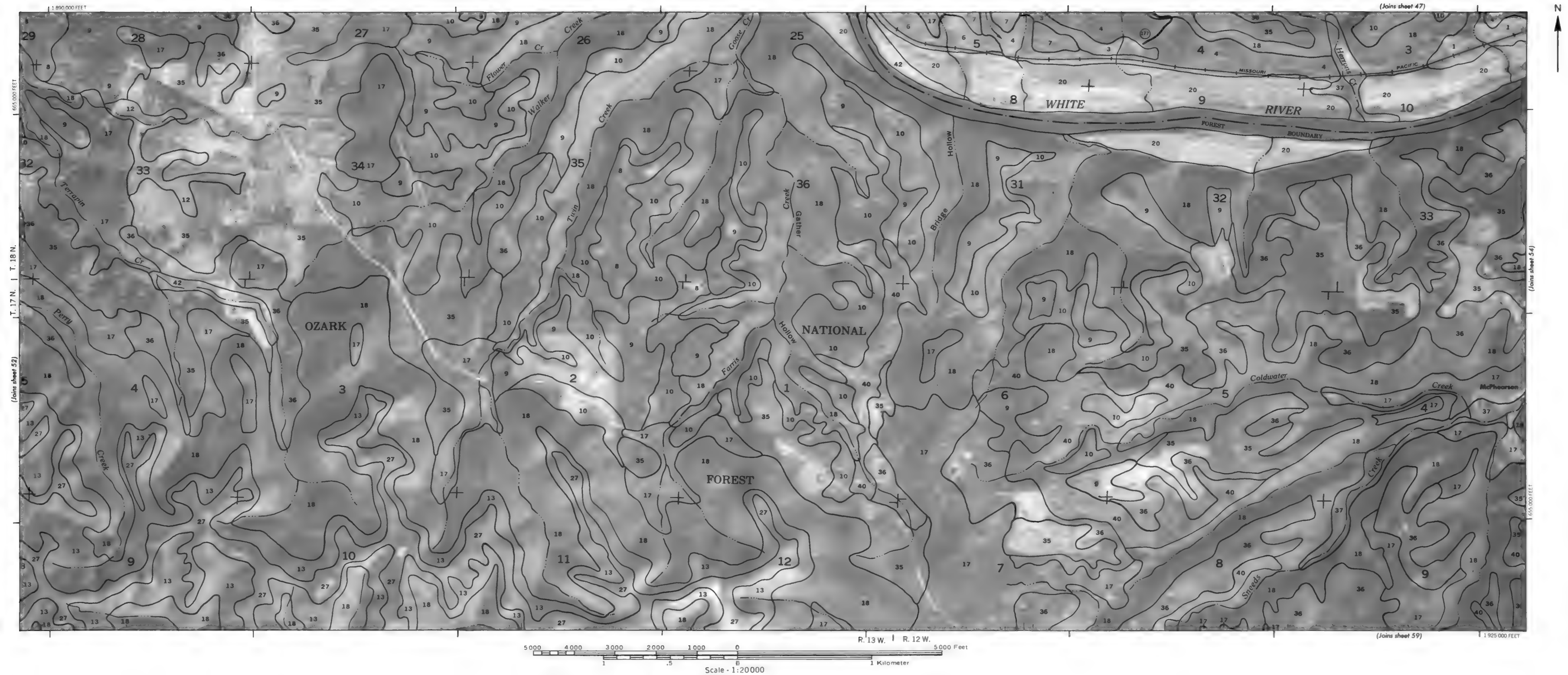
(Joins sheet 51)

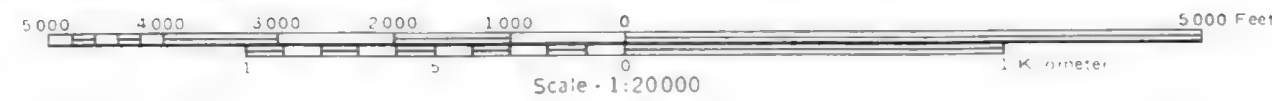
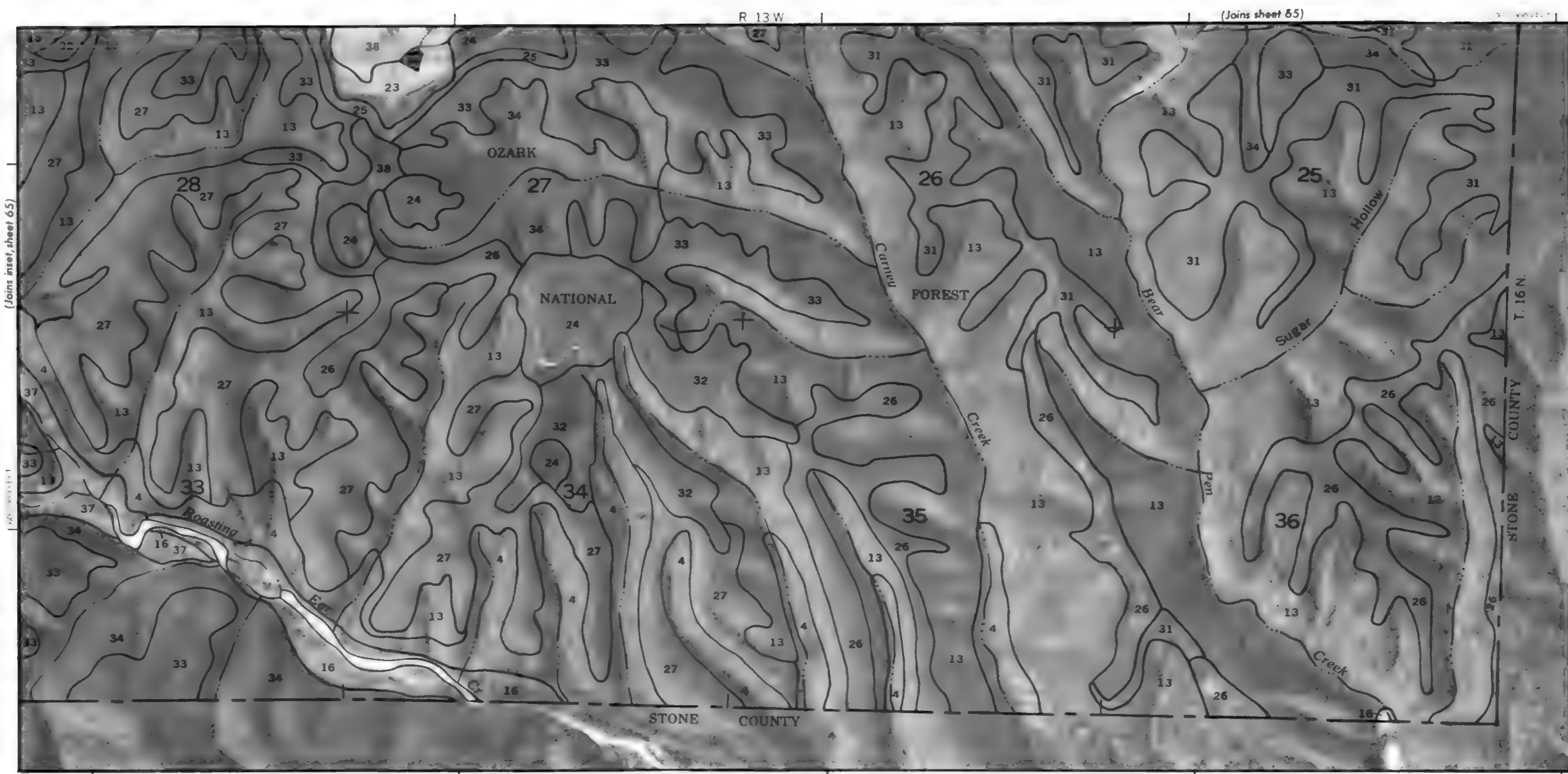
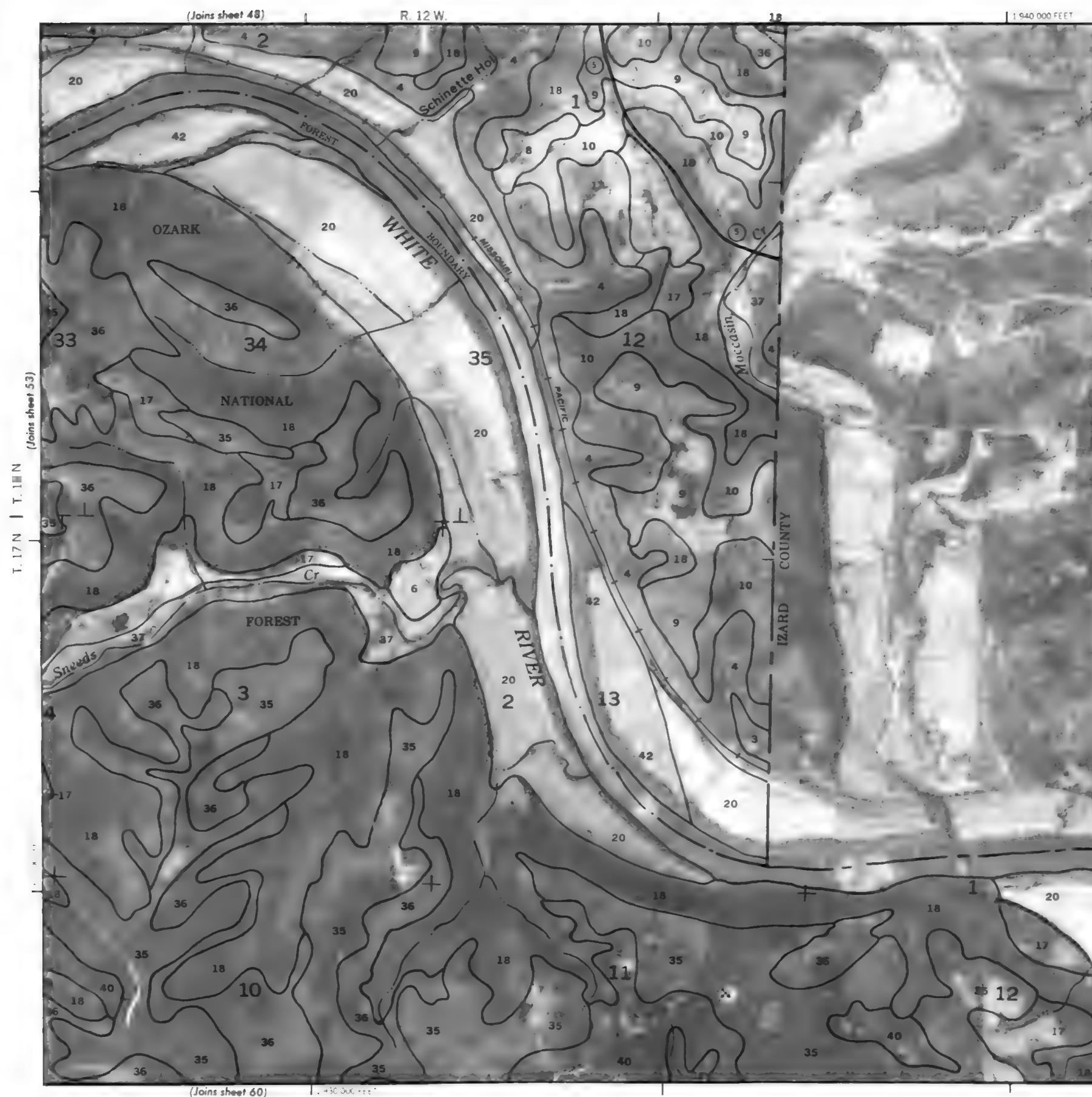
(Joins sheet 56)

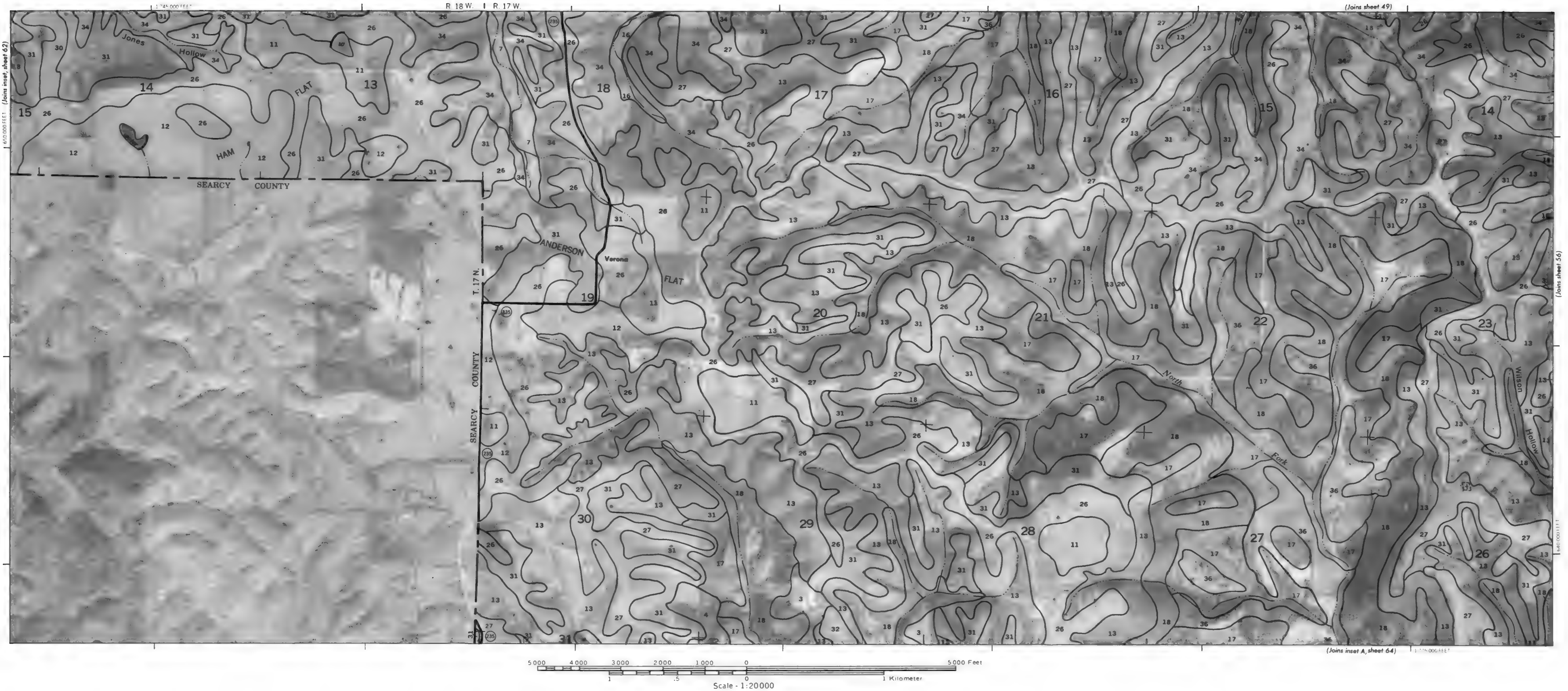






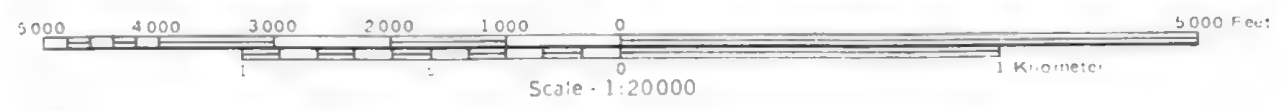
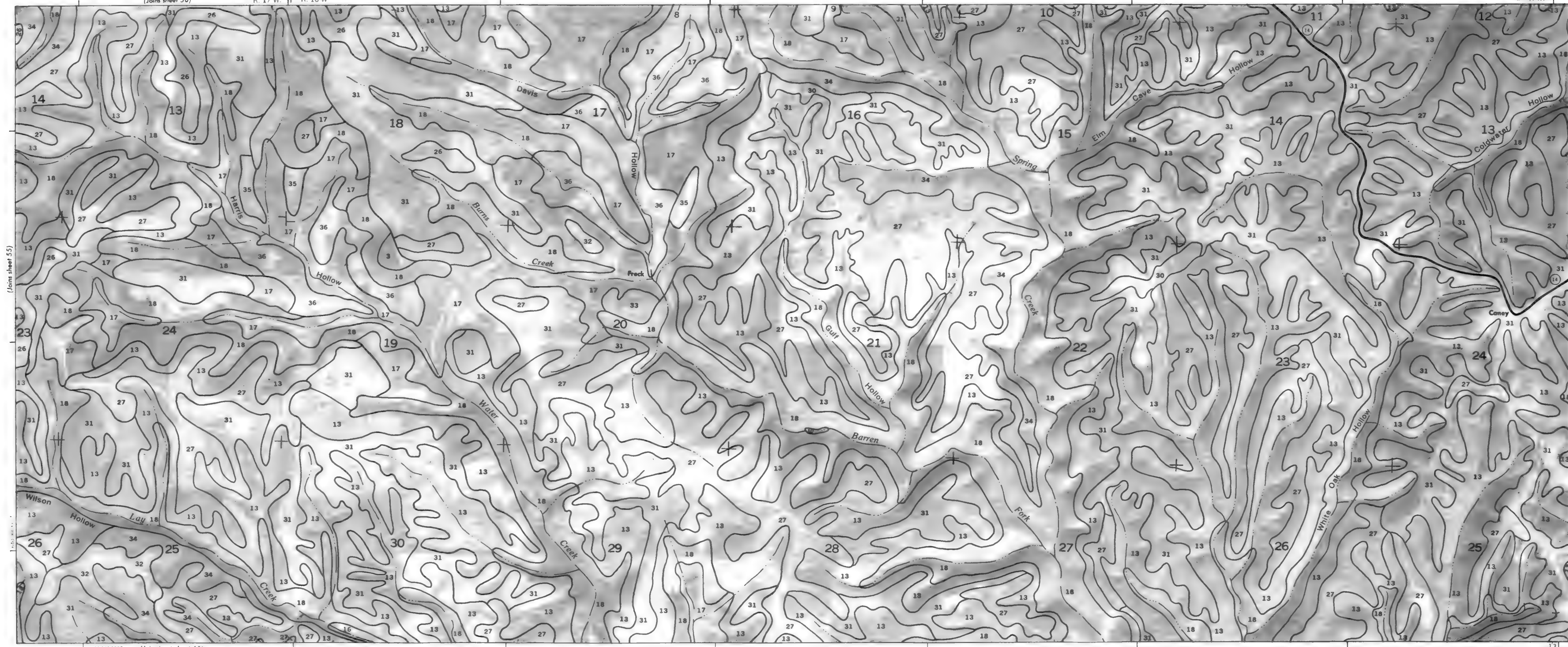








(Joins sheet 50) R. 17 W. R. 16 W.



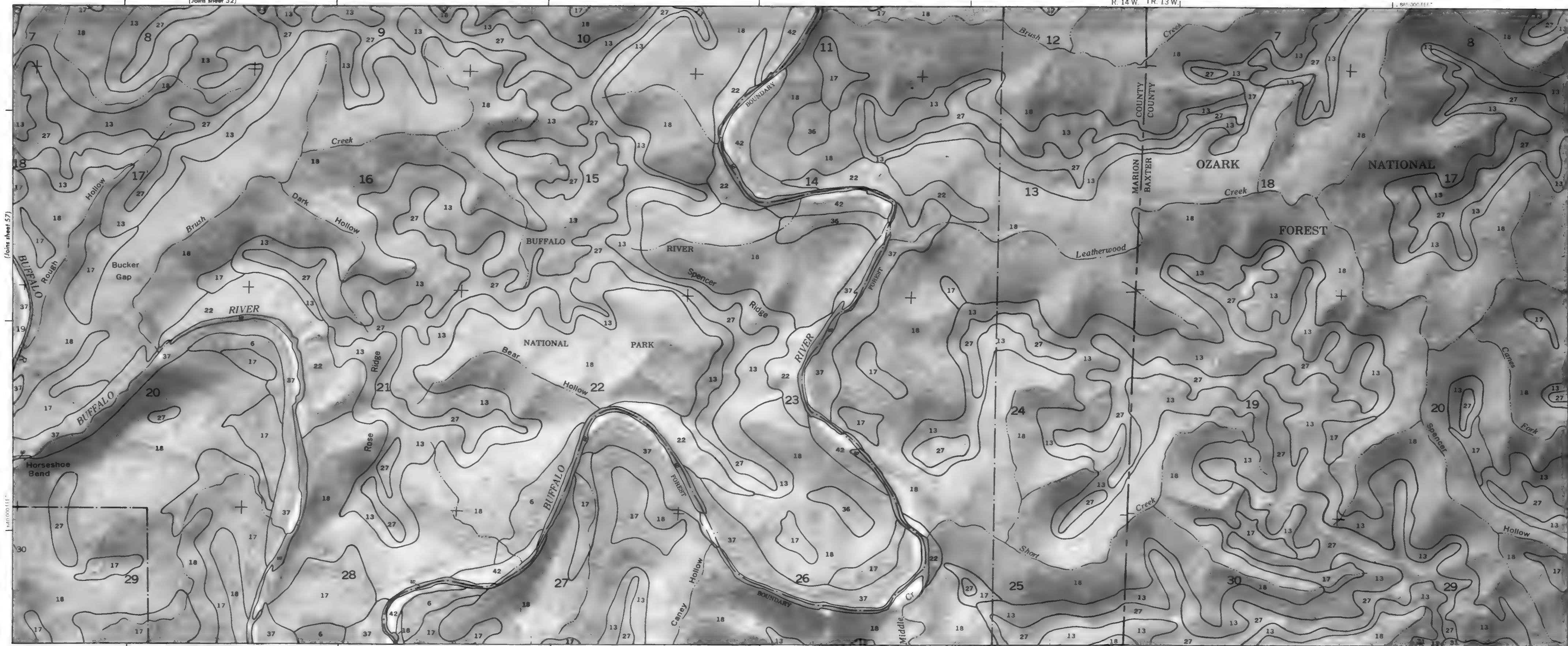




(Joins sheet 52)

R. 14 W. T. 13 N.

1:62,500 FEET



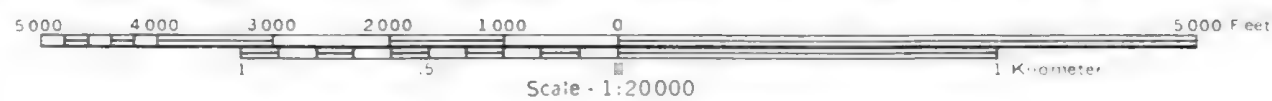
(Joins sheet 57)

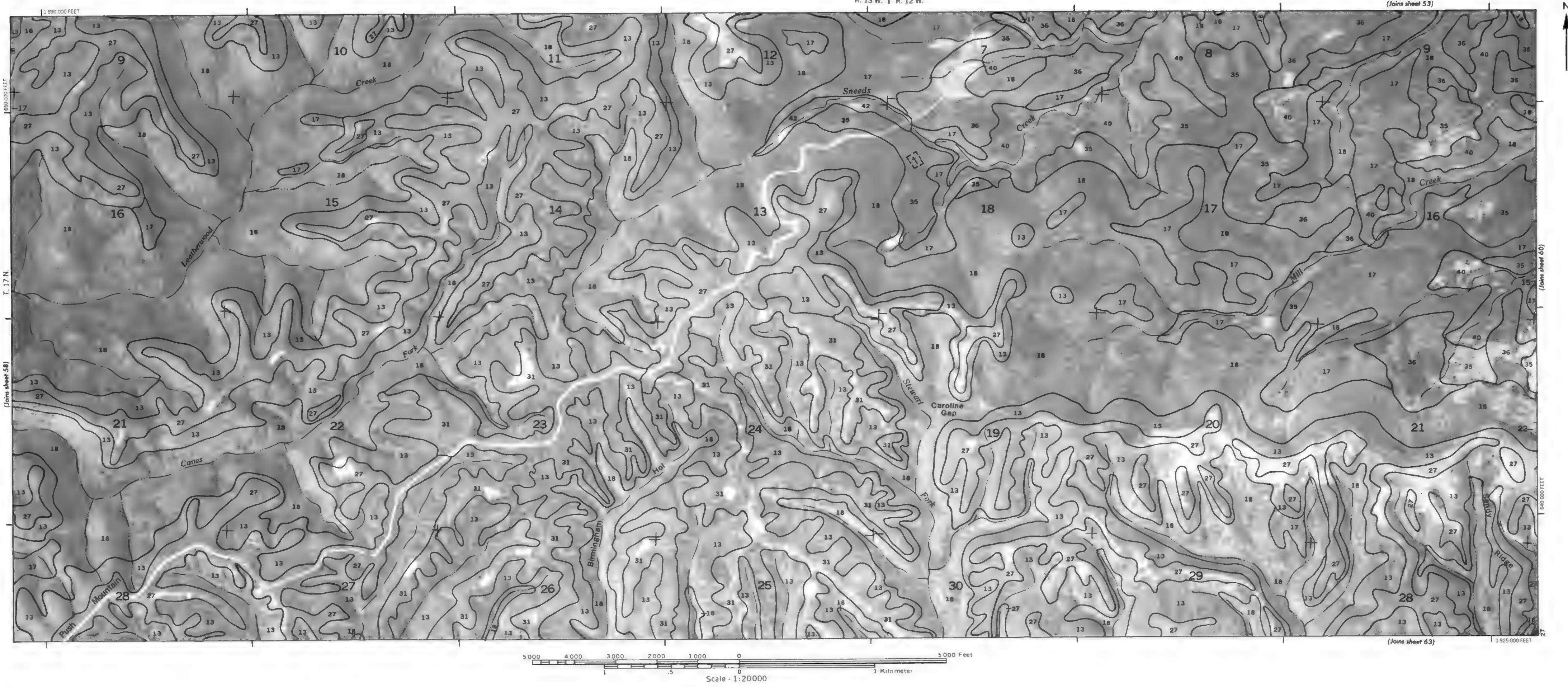
65000 FEET

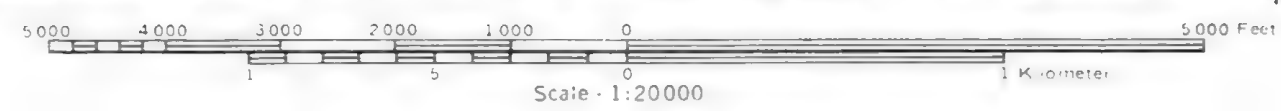
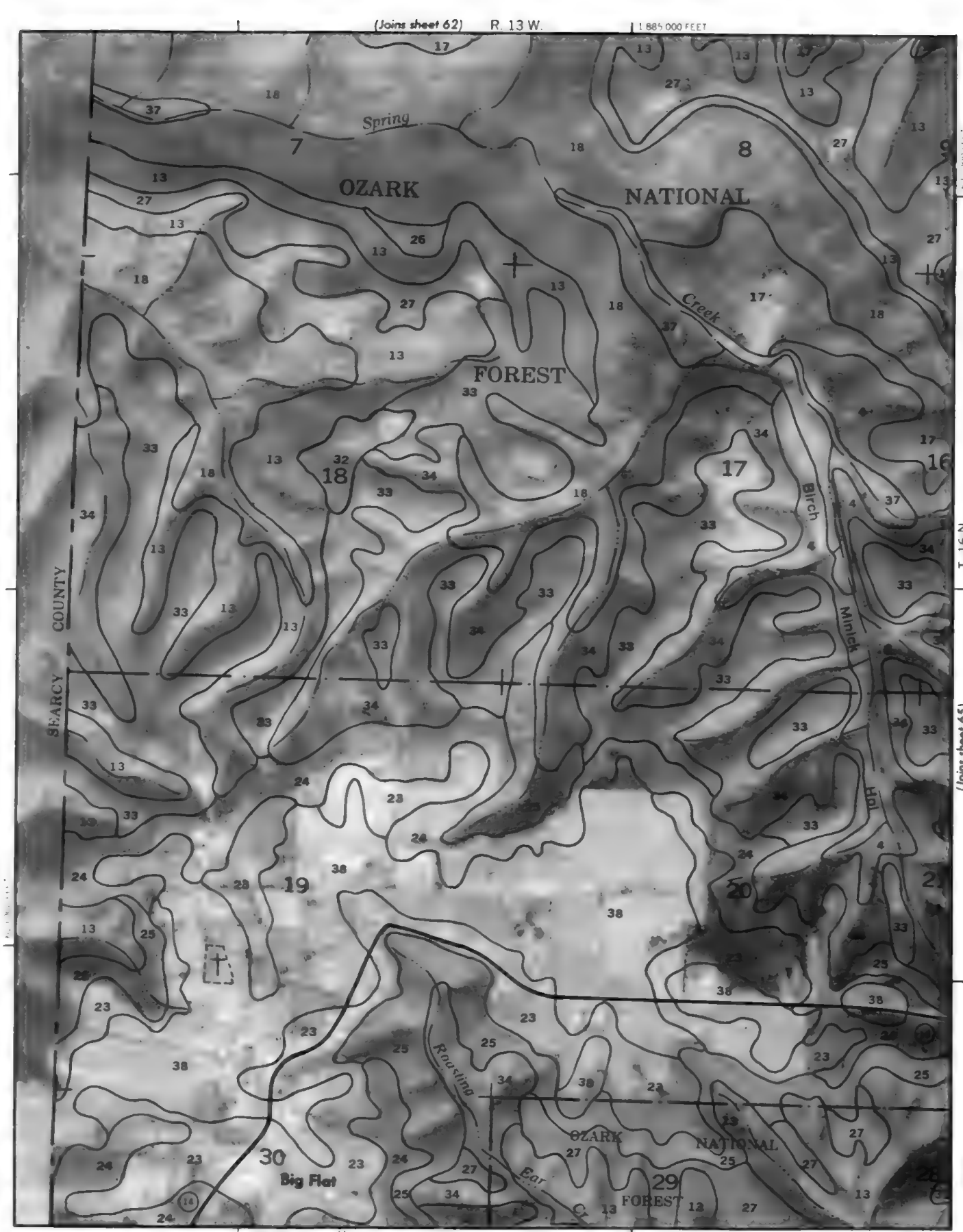
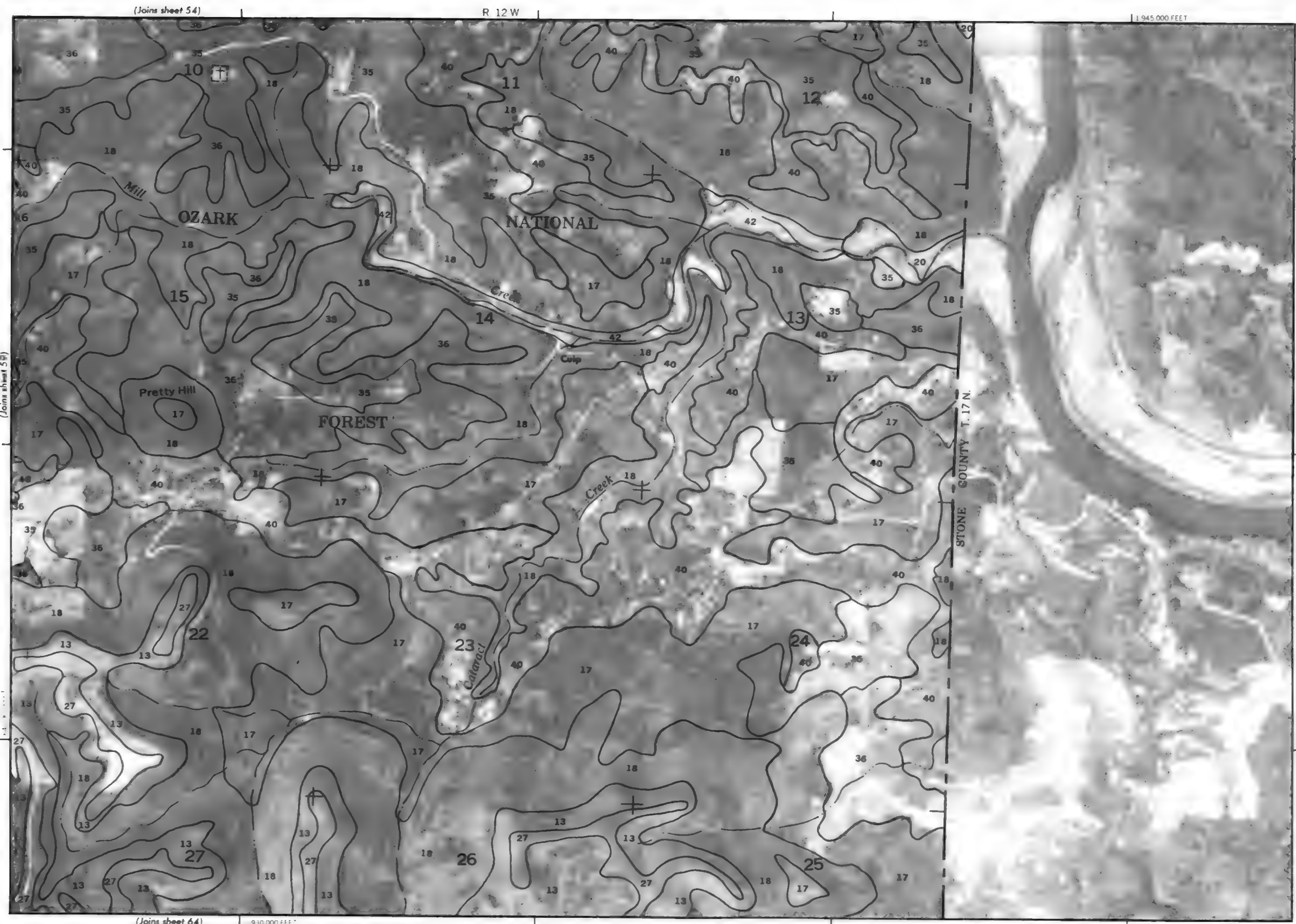
T. 17 N.

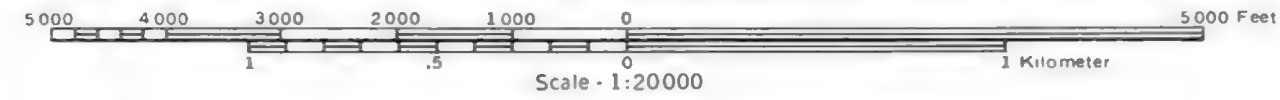
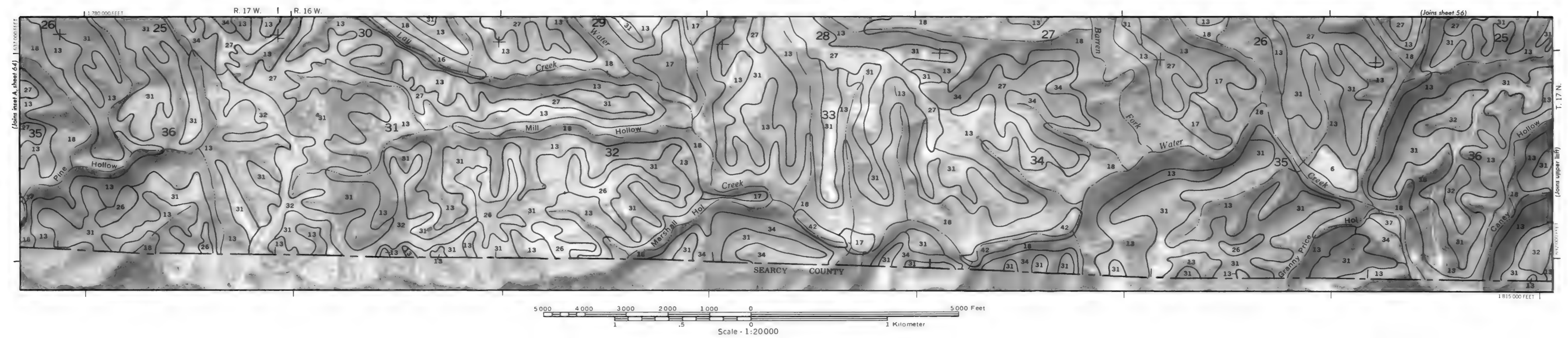
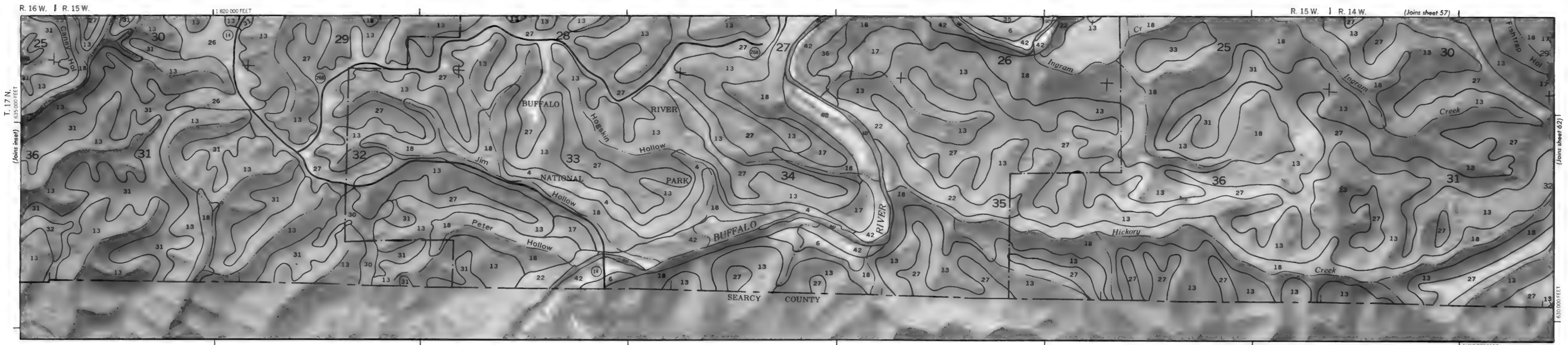
(Joins sheet 59)

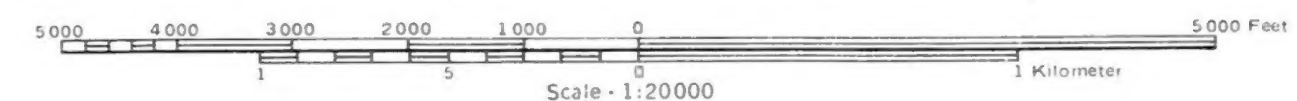
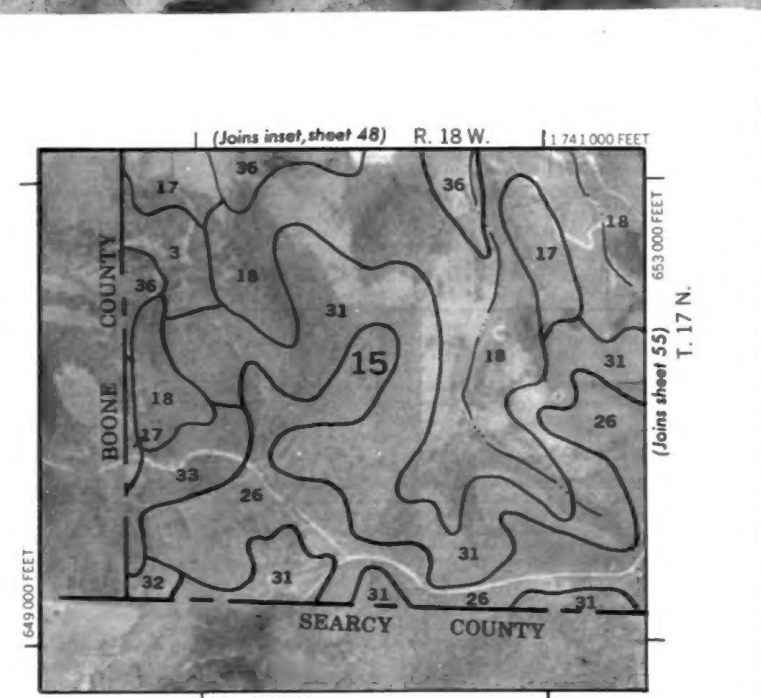
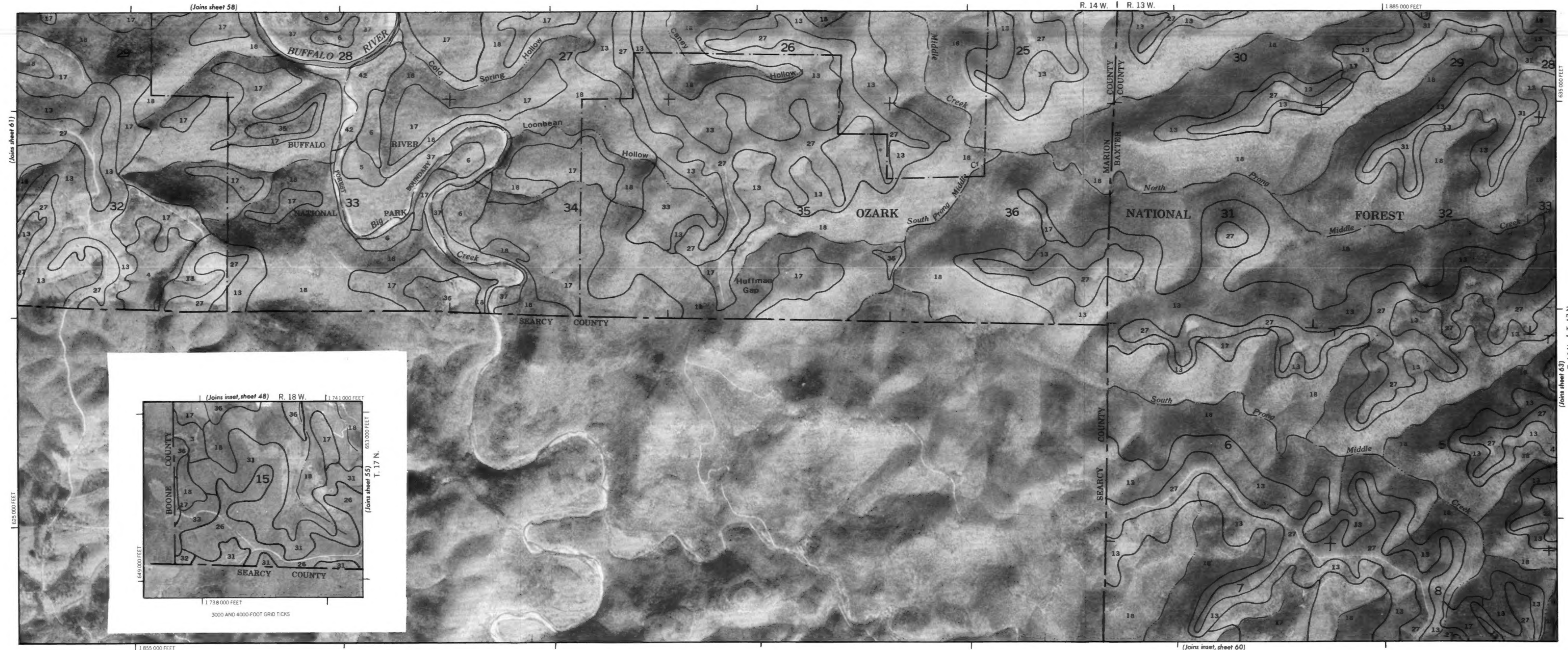
(Joins sheet 62)













T. 16 N. T. 17 N.

(Joins sheet 62)



625 000 FEET

1 925 000 FEET

